Low Stakes Quizzing: A Tool for Practice not Assessment

Thomas Rausch and Kelly McKenna
Colorado State University

Abstract: Quizzing can be beneficial as a tool for learning and practice instead of its traditional use as an assessment. Specifically, the use of low stakes quizzing (LSQ) can aid in (a) retention, (b) subsequent learning (c) corrective feedback (d) improved metacognition and (e) study habits. Best practices for utilizing quizzes are discussed, including introducing forgetting and rehearsal strategies.

Keywords: low stakes quizzing, retention, metacognition, study habits

Assessments are common methods utilized by educators to assess how well students are reaching their learning goals. Quizzing, in particular, is used as a formative assessment tool to track students' progress. However, research into the effect of quizzing has shown promise in helping students to retain information and has been cited as a tool for learning (Walck-Shannon et al., 2019). All educators want students to remember and retain what they learned from their instruction beyond the course; incorporating a low-stakes quiz (LSQ) can be used as a tool for practice, not assessment.

Benefits of Quizzing as Practice

When learning is 'lost' and neither retained nor utilized by the student, learning scrap occurs (Berk, 2008). Previous research has indicated the rate at which learning scrap occurs is troubling. Sousa (2017) wrote, "70 to 90 percent of new learning is forgotten within 18 to 24 hours after the lesson" (p. 80). A study by Silverman (2012) determined learners have forgotten 90% of learning content after a year, posing a serious problem in regard to educational outcomes.

Retention

Incorporating an LSQ to instruction can fight learning scrap and bolster retention. Sousa (2017) stated, "retention refers to the process whereby long-term memory preserves learning in such a way that it can locate, identify, and retrieve it accurately in the future" (p. 97). For this to occur, learning must be stored and then retrieved when needed. According to Bjork and Bjork (2011) storage strength "reflects how entrenched or interassociated [sic] a memory representation is with related knowledge and skills, whereas retrieval strength reflects the current activation or accessibility of that representation and is heavily influenced by factors such as situational cues and recency of study or exposure" (p. 4). Using a low-stakes quiz primarily helps students retrieve learned material. However, Bjork and Bjork note storage strength also plays a role by reducing rates of forgetting and enhancing subsequent relearning.

Increased Learning in Subsequent Modules

While a majority of the literature has focused on the use of quizzing to retain information after a learning event, such quizzes can be implemented before as an introduction to the material. The timing of utilizing a quiz as practice can be beneficial for an introductory module before subsequent studying or reading has taken place (Bjork & Bjork, 2011). By utilizing quizzing to help students learn and study, instructors can use their subject matter expertise to guide students to important points to remember. Quizzes created by the instructor emphasize important points for learning.

Corrective Feedback

While an LSQ can help students retain information, the effect is bolstered by students receiving feedback on their responses. According to Roedinger III and Butler (2011) "Correct answer feedback usually produces robust gains on a final criterion measure" (p. 20). Taking part in a LSQ helps both instructors and students to understand whether learning has been understood or not and can be far more effective than a student re-examining a chapter or text to probe for areas of improvement (Bjork & Bjork, 2011).

Metacognitive Benefits

According to Kornell and Bjork (2007) "self-regulated study involves, in the main, decisions students they make while they study on their own away from a teacher's guiding hand" (p. 219). When students engage in self-regulated study, they must make metacognitive judgements regarding their learning process and whether or not their study strategy is effective. Use of an LSQ can help to guide this process. When students struggle to answer questions provided by the instructor, this can send a clear signal further attention is required by the student on a particular area of interest (Kornell & Bjork).

Improved Study Habits

Many students engage in a "binge and purge" approach to assessments by massing their studying believing it to be both an efficient use of time and useful to pass the next test (Bjork & Bjork, 2011; Wright, 2001). This massed studying practice, more commonly known as cramming, is quite susceptible to result in learning scrap over the long term (Sousa, 2017). A study by Scharff et al. (2017) asked students about their primary consideration in selecting a learning strategy. Fifty-five percent of first year undergraduate students indicated their learning strategy was selected to "help me learn to pass the next test." A study conducted by Kornell and Bjork (2007) found similar study patterns by students, with 59% indicating they primarily studied "whatever's due soonest/overdue" (p. 222). The emphasis on passing an assessment instead of selecting a study strategy which fosters learning which is lasting is troublesome. Sustained use of an LSQ gives students the opportunity to engage in learning which is lasting rather than used perform well on the assessment, then forgotten. When student engage in studying, they must decide on whether they have reviewed the material to the point they can remember it. Participation in a LSQ

can give students immediate feedback on whether they have retained or mastered material to an appropriate extent (Kornell & Bjork). Students may even begin to engage utilize LSQ's as a study tool on their own in other courses in the absence of instructor provided quizzing.

Best Practices

Utilizing quizzing for learning practice instead of assessments has a multitude of benefits. However, educators, instructors, and teachers can implement specific strategies in using an LSQ to bolster their effectiveness.

Rehearsal

The continual processing and reprocessing of information is known as rehearsal and is a critical technique to transfer learning to long term storage (Sousa, 2017). Using an LSQ is an effective way to help students engage with rehearsal. Brain scans of learners have shown the frontal lobe is actively involved in both rehearsal practices as well as long term memory formation (Roediger III & Butler; 2011, Sousa).

Rote and Elaborative Rehearsal

Rehearsal has two types of forms: rote and elaborative. In rote rehearsal, the learner is tasked with remembering precisely what is taught for future replication. Rote rehearsal is often associated with closed based skills; as the name suggests, learners are expected to reproduce learning as a matter of rote and routine and is often useful for fact and data acquisition. In elaborative rehearsal, learners are not directed to precisely reproduce learning, but rather to "associate new learnings with prior learning to detect relationships" (Sousa, 2017, p. 98). Elaborative rehearsal is critical for fostering open based skills, where the learner discovers underlying principles and techniques for creative application in the future. Elaborative rehearsal is best suited for analysis and reflective outcomes (Sousa, 2017).

Both rote and elaborative rehearsal have merit; however, the decision to include one or both in the learning design depends on the desired outcomes of learning. Many skills-based trainers favor rote rehearsal, while learning sessions that require higher-order thinking are best suited for elaborative rehearsal, as it compels learners to deeply understand the concepts, their relation to one another in a variety of settings (Sousa, 2017).

When incorporating elaborative rehearsal as a part of an LSQ (Sousa, 2017) recommended several practices to help students engage with rehearsal:

- Help students understand the difference between rote and elaborative rehearsal and their connection to outcomes
- Ensure rehearsal question types are relevant for students which foster meaningful connections to prior learning
- For elaborative rehearsal outcomes, questions should be open-ended. By asking

students to write responses in their own words, retention is enhanced
- The use of summarizing (called closure) can help students attach sense and meaning making to their learning at the end of a lesson.

Desirable Difficulties

If instructors and educators wish to create learning outcomes that are lasting, the conditions in which recall takes place should be onerous to the learner. Put another way, the more learners struggle to remember key content, the more likely information will be retained for future use. Bjork and Bjork (2011) refer to this as creating desirable difficulties for students. Researchers have discovered memory pathways are strengthened when forgetting has occurred; recall conditions in which students struggle to remember boosts retention (Sousa, 2017). In regard to using quizzes as a practice tool rather than an assessment, the quizzes should feature the desirable difficulties and challenges described below.

Forgetting

One of the best ways to help students retain what they learn is to help them to forget (Bjork & Bjork, 2011). Forgetting, as it pertains to recall and retention, is a desirable condition for students. According to Souza (2017) "forgetting is viewed as the enemy of learning. But, on the contrary, forgetting plays an important role in promoting learning and facilitating recall" (p. 129).

The Generation Effect

The generation effect, which refers to the long-term benefit of generating an answer, solution, or procedure versus being presented that answer, solution, or procedure has been shown to boost retention (Bjork & Bjork, 2011). Closely associated with elaborative rehearsal outcomes, when students are asked to answer questions by summarizing their learning in their own words, as opposed to answering forced-choice quiz items, retention is bolstered. Roediger III and Butler (2011) noted, "the act of calling formation to mind rather than rereading it or hearing it…produces an effort from within to better induce retention" (p. 20).

Spacing

"The spacing effect is one of the oldest and best documented phenomena in the history of learning and memory research" (Bahrick & Hall, 2005, p. 566). Quizzing should be spaced to allow forgetting to occur (Bahrick & Hall; Howard-Jones, 2014). In other words, engaging with LSQ's should take place far enough apart that learners cannot readily remember the answers and must make an effort to recall them. When learners struggle to remember the correct answer, they are actually developing their ability to recall. According to Thalheimer (2006):

> Research suggests that spaced retrieval practice can generate learning by first prompting retrieval failure. When learners fail to retrieve information from memory

that failure can serve as a warning. Subsequent opportunities to learn information related to the previous failure generate more vigorous and constructive learning behaviors. (p. 21)

The amount of time between each LSQ should be determined by how well students remember. The easier the recall, the instructor should lengthen the time between LSQ's.

Interleaving

Repeated rehearsal enhances retention. However, retention is further bolstered when the order in which the items on a LSQ are presented in a different order than the first attempt (i.e. abcbcacab v. aaabbbccc). This concept is known as interleaving. A study conducted by Taylor and Rohrer (2010) determined interleaving (distinct from spacing) doubled scores on a test given the next day. For adult educators and students, this means when students are repeated quizzed on material over the course of several weeks, the order in which the quiz questions are given should not be repeated from the previous quiz.

Overlearning

According to Bjork and Bjork (2011) "The basic problem learners confront is that we can easily be misled as to whether we are learning effectively and have or have not achieved a level of learning and comprehension that will support our subsequent access to information or skills we are trying to learn" (p. 3). This problem can be further exacerbated because students often underestimate how well they've learned and retained information (Driskell et al., 1992; Kornell & Bjork, 2007). To address the overestimation of how well students retain material, instructors should encourage the use of overlearning. According to Driskell et al. (1992), "overlearning refers to the deliberate overtraining of a task past a set criterion" (p. 615). Overlearning is especially important within the context of self-regulated study and metacognition because students must continue to quiz themselves well past the point they intuitively feel they have sufficiently remembered the concept.

Stimulus Variability

According to Bjork and Bjork (2011), "when instruction occurs under conditions that are constrained and predictable, learning tends to become contextualized" (p. 5). This can be a problem for recall, because it can be difficult to determine if lasting, transferrable learning is occurring or if learning is simply being reproduced on the basis of contextual and environmental cues (Bjork & Bjork; Roediger III & Butler, 2011; Sousa, 2017). Learners may only be able to retrieve information from long-term memory in the same conditions in which they learned and studied, making performance problematic (Bjork & Bjork). To enhance learning outcomes using an LSQ, instructors should vary the rehearsal strategies initiated by the instructor. This is known as stimulus variability and can enhance retention and transfer. For example, when prompted by the LSQ, have students both write and speak the answers (or mix them up). The prospects of long-term storage and retention are greatly enhanced when students are asked to both practice writing and speaking their responses (Sousa). Bjork and Bjork also suggested having learners complete LSQ's in differing

environments, so they do not become accustomed to relying on environmental cues for retrieval.

Conclusion

Utilizing quizzes as a tool for practice can be beneficial for students. Areas subject to benefit include, but are not limited to improved retention, enhanced performance on future learning, corrective feedback, and bolstered metacognition and study habits. By utilizing rote and rehearsal strategies, as well introducing desirable difficulties in learning and remembering, quizzing can be an effective learning tool to help students reach their goals.

References

Bahrick, H. P., & Hall, L. K. (2005). The importance of retrieval failures to long-term retention: A metacognitive explanation of the spacing effect. *Journal of Memory and Language*, *52*(4), 566-577.

Berk, J. (2008). The manager's responsibility for employee learning. Chief Learning Officer. https://www.chieflearningofficer.com/

Bjork, E. L., & Bjork, R. A. (2011). Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning. In M. A. Gernsbacher, R. W. Pew, L. M. Hough, & J. R. Pomerantz (Eds.) & FABBS Foundation, *Psychology and the real world: Essays illustrating fundamental contributions to society* (pp. 56-64). Worth Publishers. https://www.researchgate.net/publication/284097727_Making_things_hard_on_yours elf_but_in_a_good_way_Creating_desirable_difficulties_to_enhance_learning

Driskell, J. E., Willis, R. P., & Copper, C. (1992). The effect of overlearning on retention. *Journal of Applied Psychology, 77*(5), 615-622.

Howard-Jones, P. (2014). Neuroscience and education: A review of educational interventions and approaches informed by neuroscience. The Education Endowment Foundation. https://educationendowmentfoundation.org.uk/evidence-summaries/evidence-reviews/education-and-neuroscience/

Kornell, N. & Bjork, R. A. (2007). The promise and perils of self-regulated study. *Psychonomic Bulletin & Review*, *14*(2), 219-224.

Roediger, H. L., III, & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Science*, *15*(1), 20-27.

Scharff, L., Draeger, J., Verpoorten, D., Devlin, M., Dvorakova, L. S., Lodge, J. M., & Smith, S. (2017). Exploring metacognition as support for learning transfer. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahU KEwiEprTxtabtAhWPG80KHa9sAE4QFjACegQIAxAC&url=https%3A%2F%2Fjo urnalhosting.ucalgary.ca%2Findex.php%2FTLI%2Farticle%2Fdownload%2F57464 %2F43232%2F&usg=AOvVaw2ZcruOSkMx6jM6AvNzT7d-

Silverman, R. (2012, October 26). *So much training, so little to show for it*. Wall Street Journal. https://www.wsj.com/articles/SB10001424052970204425904578072950518558328

Sousa, D. A. (2017). How the brain learns. (5th ed.). Corwin.

Taylor, K. & Rohrer, D. (2010). The effects of interleaved practice. *Applied Cognitive Psychology*, *24*(6), 837-848.

Thalheimer, W. (2006). Spacing learning events over time: What the research says. www.work-learning.com

Walck-Shannon, E. M., Cahill, M. J., McDaniel, M. A., & Frey, R. F. (2019). Participation in voluntary re-quizzing is predictive of increased performance on cumulative assessments in introductory biology. *CBE—Life Sciences Education*, *18*(2), 1-13.

Wright, G.B. (2011). Student-centered learning in higher education. *International Journal of Teaching and Learning in Higher Education*, *23*(3), 92-97.