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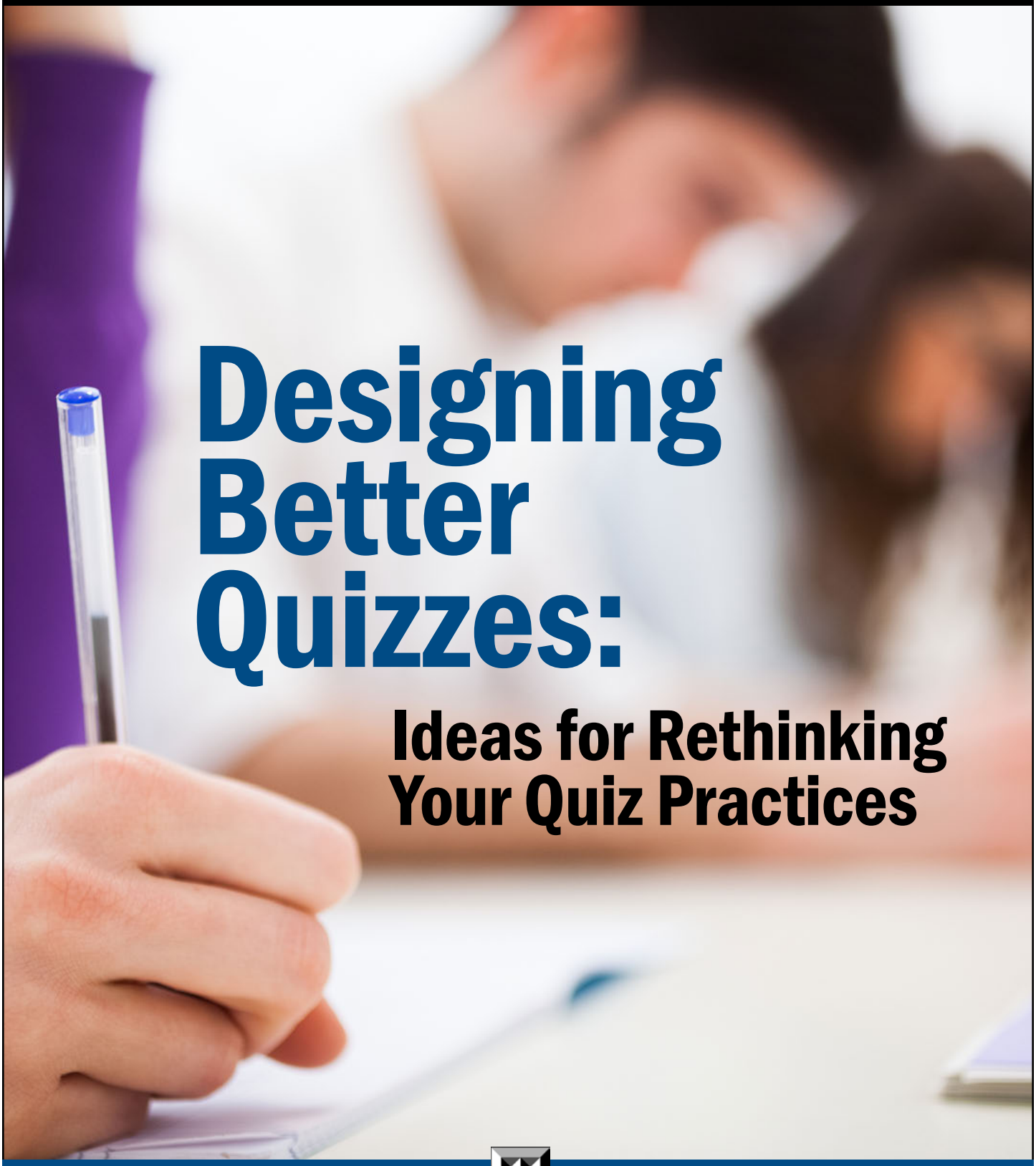

Designing Better Quizzes:

Ideas for Rethinking Your Quiz Practices

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Designing Better Quizzes:
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Five Types of Quizzes That Deepen Engagement with Course Content

By Maryellen Weimer, PhD

I've been rethinking my views on quizzing. I'm still not in favor of quizzes that rely on low-level questions where the right answer is a memorized detail or a quizzing strategy where the primary motivation is punitive, such as to force students to keep up with the reading. That kind of quizzing doesn't motivate reading for the right reasons and it doesn't promote deep, lasting learning. But I keep discovering innovative ways faculty are using quizzes, and these practices rest on different premises. I thought I'd use this post to briefly share some of them.

Mix up the structure — Elizabeth Tropman makes a strong case for reading quizzes (highlights from her piece appear in the March issue of *The Teaching Professor*). She changes up quiz structures on a regular basis. Sometimes it's the usual objective questions, other times it's short-answer questions, or it might be a question that asks for an opinion response to the reading. Some quizzes are open-book; a few are take home. What an interesting way to give students experience responding to different kinds of test questions and to keep quiz experiences from becoming stale.

Reference: Tropman, E., (2014). In defense of reading quizzes. *International Journal of Teaching and Learning in Higher Education, 26* (1), 140-146.

Collaborative quizzing — Lots of different options are being used here. Students do the quiz, turn it over, stand up and talk with a partner, to others in a small group, or with whomever they choose. After the discussion, they return to their quiz and may change any of their answers. Alternatively, students do the quiz individually, turn it in, and then do the same quiz in a small group. The two quiz scores are combined with the individual score counting for 75% of the grade and the group quiz 25% (or some other weighted variation). Collaborative quizzing is an effective way to generate enthusiastic discussion of course content and reduce test anxiety.

Reference: Pandey, C., and Kapitanoff, S. "The Influence of Anxiety and Quality of Interaction on Collaborative Test Performance." *Active Learning in Higher Education,* 2011, *12* (3), 163-174.

Quizzing with resources — Students take detailed notes on the reading because they're allowed to use those notes during the quiz. The same approach works with quizzes that cover content presented during class. Students may use their class notes while taking the quizzes. The pay-off is a good (or better) set of notes for use during exam preparation. Ali Resaei reports that open-note quizzing coupled with collaboration resulted in significantly higher final exam scores in his quantitative research methods course.

Reference: Rezaei, A. R., (2015). Frequent collaborative quiz taking and conceptual learning. *Active Learning in Higher Education, 16* (3), 187-196.

Quizzing after questioning — Before the quiz occurs, students are given the opportunity to ask questions about potential quiz content. The instructor and the class work on finding the right answer or discussing the merits of possible responses. If someone asks a question that stimulates a lot of good discussion, that question becomes the quiz question and students have the designated amount of time to write an answer. Or if a variety of good questions have been asked, answered, and discussed by a variety of students, the professor who shared this option may tell students they've just had their quiz and everyone present gets full credit. This approach encourages students to ask better questions and facilitates substantive classroom discussions.

Online quizzes completed before class — Students complete an online quiz before class. The quizzes are graded electronically with a compiled summary going to the professor so there's enough time to look at the most frequently missed problems and/or to identify areas of misunderstanding. Then class time can be used to address those concepts that are giving students the most trouble.

The advantage of regular quizzes is that they provide ongoing opportunities for retrieval practice and much cognitive psychology research (like that summarized in the reference that follows) documents the benefits of frequent testing. Regular quizzing does improve class

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attendance and it gets more students coming to class prepared. Those are not trivial benefits, but with a few different design features, quizzes can also promote deeper engagement with the content, further the development of important learning skills, and provide teachers and students with feedback that promotes learning.

Reference: Brame, C. J. and Biel, R., (2015). Test-enhanced learning: The potential for testing to promote greater learning in undergraduate science courses. *Cell Biology Education—Life Sciences Education, 14* (Summer), 1-12.

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An Innovative Quiz Strategy

By Maryellen Weimer, PhD

Here's an interesting way to incorporate collaboration in a quizzing strategy, with some pretty impressive results.

Beginning with the mechanics: students took three quizzes in an introductory pharmaceutical science course. First, they completed the quiz individually. After answering each question, they indicated how confident they were that their answer was correct—5 for absolutely certain and 1 for not knowing and guessing. Then for a period of time (length not specified in the article), they were allowed to collaborate with others seated near them on quiz answers. After that discussion, they could change their quiz answers, if they desired. At that point, they again rated their confidence in the correctness of the answers. Quiz answer sheets and confidence levels were then turned in. Immediately, correct quiz answers were revealed and once again students had the opportunity to discuss answers with each other.

An interesting scoring mechanism was used as well. Each correct answer was given a point, which was multiplied by the confidence rating assigned. With incorrect answers, the half a point off was multiplied by the confidence level and that amount deducted. If the question was unanswered, no points were added or deducted. The confidence scores were incorporated to encourage students to analyze their answers and confront how well they understood content needed to answer the question. They were deducted as a way to discourage guessing but to make the penalty smaller if a "guessed" answer was acknowledged.

An analysis of student answers revealed that answers were changed about 10 percent of the time, and 77 percent of them were changed in the direction of the right answer. The rest of the time a correct answer was changed to an incorrect one—suggesting a condition called "regressive collaboration." In these cases, a more persuasive but not always correct student was able to convince another student to change from a correct to incorrect answer. However, the percentage of answers changed decreased significantly in the third quiz and the percentage of right answers changed to wrong decreased as well. Moreover, when students changed from a right answer to a wrong one, researchers think that may have precipitated even more analysis and insights.

Data show that student confidence in their answers increased as a result of the discussion with their peers. And feedback from students indicated their positive response to the approach. "The opportunity to discuss answers with my neighbors helped me learn during the quizzes" was agreed with by 86 percent of the students. Only 3 percent disagreed with the statement. The opportunity to discuss answers during the quiz was given to all students, but participation in this discussion was not required, and a small number of students chose not to participate in these exchanges.

The authors conclude, "It is reasonable to suggest that an approach in which assessment is viewed as a learning opportunity is likely to provide greater benefits to the student than one which seeks only to quantify what has been learned previously. In addition, the possibility of engaging in collaborative exchange is a more realistic approximation of real-life problem-solving, in which individuals are able to share their expertise in the solution of a problem or accomplishment of a task." (p. 115)

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Reference: Sainsbury, E. J. and Walker, R. A. (2008). Assessment as a vehicle for learning: Extending collaboration into testing. *Assessment & Evaluation in Higher Education, 33* (2), 103-117.

Maryellen Weimer is a professor emerita at Penn State Berks, editor of The Teaching Professor newsletter, *a distinguished scholar, and an author.*

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A Quiz That Promotes Discussion and Active Learning in Large Classes

By Patricia L. Stan, PhD

Educational research is full of studies that show today's students learn more in an active-learning environment than in a traditional lecture. And as more teachers move toward introductory classes that feature active-learning environments, test performance is improving, as is interest in these classes. The challenge for teachers is finding and developing those effective active-learning strategies. Here's a take-home quiz activity that I've adapted and am using to get students interested in my course content.

I teach a large, non-major chemistry course. I try to include topics such as pollution sources, alternative fuels, nutrition videos, and hometown water supplies that are relevant to students in different majors. I give a five-question quiz assignment several days before the topic comes up in class and then use it to facilitate class discussion. I want students thinking and applying course content. The first thing I ask for is a link to a recent article or video of interest to the student within the designated topic area (e.g., Find a recent article that describes an alternative energy source). Question two asks for a general understanding or definition (e.g., Is this energy source renewable or nonrenewable? Explain.). Next are questions that encourage students to interpret what they've read and assess its reliability (e.g., How does this energy source compare to oil and coal? Or how will this energy source help meet our current and future energy needs?). The quiz wraps up with a question that asks for the student's opinion on the topic (e.g., Burning garbage to produce electricity is an alternative fuel—would you be happy to see your town adopt this method? Explain.).

Elements in this assignment connect with the documented learning needs of millennial students. The quiz covers topics that are current and relevant. It asks for a personal application. Students use technology; they insert a link to the article and look it up/turn it in online. I stipulate news sources, no blogs or Web pages, so that they learn to be discerning in their use of the technology. Their opinions matter, and they are asked to express them. Last, they are rewarded for work—as long as they put forth reasonable effort, they get full credit.

The activity also fits with my teaching priorities. It's an assignment that prepares students to actively participate in our discussion of the topic. I can call on anyone without putting him or her on the spot. I scan their answers ahead of time, which allows me to highlight points related to my learning outcomes. The questions push students to engage with the material on a deeper level. They are encouraged to use logic and science to support their opinions. As we discuss, I can share my interpretation and ask for theirs. We deal with topics on which beliefs and opinions differ. During these exchanges students are challenged to be critical of what they read. Their growing knowledge of science helps them better support their beliefs and propose wiser decisions. And I can explain that science is not always right. As scientists learn more, what we believe and the actions we propose change as well.

Being able to pick topics of interest motivates students. Our discussions are informal and lively. I have found this approach reduces the fear of giving a wrong answer in front of the class, so more students participate. These discussions help me understand how those outside chemistry view it. I look forward to these discussions

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because I get to know students, and they get to see how a scientist thinks. Sometimes they are surprised to learn that we don't have all the answers.

After a take-home quiz discussion, I often get emails from students with more article links related to our discussions. The formula for this activity isn't new—have students look something up, relate it to what is being studied, apply it to their lives, and express their opinions. However, I've discovered that using it as a quiz effectively prepares and motivates students for class discussions of the topic.

Patricia L. Stan is an associate professor of chemistry at Taylor University.

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Examining Your Multiple-Choice Questions

By Maryellen Weimer, PhD

As Ron Berk (known for his pithy humor) observes, the multiple-choice question "holds world records in the categories of most popular, most unpopular, most used, most misused, most loved and most hated." According to one source I read, multiple-choice questions were first used around the time of World War I to measure the abilities of new Army recruits. As class sizes have grown and the demands on teacher time expanded, they have become the favorite testing tool in higher education.

However, even those who use them often aren't all that crazy about them and with good reason. How many problems faced by professionals come in a multiple-choice format? Answering multiple-choice questions doesn't teach students how to formulate answers; it teaches them how to select answers. And sometimes choosing the correct answer is more a function of literary skill than content knowledge. Multiple-choice questions encourage guessing, and if the guess is correct, students get credit for something they didn't know. Answer options contain misinformation—that's what makes them wrong. As students read and consider all the possible answers, they are exposed to incorrect content, which some research has shown influences subsequent thinking about the topic.

Many multiple-choice questions don't challenge students to think but rather encourage them to memorize. Test bank questions are the worst. Analysis of questions in a variety of disciplines documents that around 85% of the questions test lower-level knowledge. And I've already referenced in the blog and lots of other places a very rigorous analysis of test questions on biology exams. "Of the 9713 assessment items submitted … by 50 faculty teaching introductory biology, 93% were rated at Bloom's level 1 or 2—knowledge and comprehension." (p. 437)

Clegg and Cashin in a classic (but still very helpful) paper write, "It is true that many multiple-choice items are superficial, but that is the result of poor test craftsmanship and not an inherent limitation of the item type. A well designed multiple-choice item can test high levels of student learning." And that's not all multiple-choice questions can do well. They can ascertain student knowledge of a wide range of topics in a timely manner. Best of all, they are quick and easy to grade.

The problem is writing those kinds of challenging questions. It takes careful thought and creativity to write a question that requires thinking to answer, and for most teachers that equates to time. Professional test question writers like those writing items for the SAT, ACT, and GRE devote hours to creating and testing questions.

The reasons and realities that motivate using multiple-choice questions are compelling. So the question is, how do we help faculty write good ones? I'm going to follow this post with one that reviews the do's and don'ts of writing good questions. But before that, I encourage you to take a long hard look at the multiple-choice questions on your exams. When the low level of multiple-choice test questions is discussed, most faculty quickly assert that their questions are rigorous and do challenge thinking. A number of years ago, a cross-disciplinary faculty cohort reported that a third of their questions measured complex

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cognitive skills. An analysis showed that only 8.5% of their questions did, with the remaining testing basic comprehension and recall. Being objective isn't easy, but it's necessary.

Jacobs and Chase recommend that faculty write multiple-choice questions as they go (not all at once, right before the exam). If the questions are filled with the content pertaining to them, they could be reviewed, revised, or rewritten as part of class preparation. It isn't always necessary to re-do the whole question. Sometimes an answer option is all that needs to be replaced or revised. And there's no need for every question to test higher order thinking skills. Most of us could use a few more, but sometimes we do need to test basic knowledge.

References:

Momsen, J. L., Long, T. M., Wyse, S. A., and Ebert-May, D. (2010) Just the facts? Introductory undergraduate biology courses focus on low-level cognitive skills. *Cell Biology Education, 9* (Winter), 435-440.

Clegg, V. L, and Cashin, W. E. (1986). Improving Multiple-Choice Tests. *IDEA Paper No. 16*. Available for free at: www.theideacenter.org.

Jacobs, L. C. and Chase, C. I. *Developing and Using Tests Effectively: A Guide for Faculty*. San Francisco: Jossey-Bass, 1992.

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A Quiz Design that Motivates Learning

By Maryellen Weimer, PhD

Many faculty members use quizzes to keep students prepared and present in class. The approach often tends to be punitive, however, motivating students by extrinsic means. Karen Braun and Drew Sellers, who teach beginning accounting courses, wanted to use quizzes in the usual ways—to get students coming to class having done the reading, to arrive in class on time, and to participate in class discussion, but they wanted their quizzes to be more about intrinsic motivation and less about assessment. How did they achieve that objective? They incorporated a number of "motivational" design features into their use of quizzes.

The questions asked on their quizzes are conceptual. "Since most introductory accounting students are not accounting majors, conceptual knowledge is arguably at least as important as procedural knowledge." (p. 269) Each of the three questions on any given quiz addresses key ideas from the assigned reading. Moreover, during the quiz students are allowed to use any notes they've taken while doing the reading. This design feature gives students a reason to take notes on the reading rather than just quickly skimming it, and it provides students with a collection of notes from the reading that can be used as they prepare for exams.

Students pick up the daily quiz as they arrive in class. They have five minutes to complete it, and when they turn it in they retrieve their graded quiz from the previous class. After five minutes, the collection basket for the quizzes is removed and quizzes can no longer be submitted. This detail gets students to class on time. The short time frame also means test questions are answered briefly, which means they can be graded quickly, a motivational issue for teachers.

These quizzes count for 10 percent of the student's course grade. Makeups are not allowed, but the three lowest quiz scores are dropped when course grades are calculated. Students can also "make up" one missed quiz question per day by voluntarily participating in class discussions. "This practice spurs students to engage in class discussions." (p. 271)

It's also another design feature that benefits the teacher: They have students eagerly volunteering to participate during class discussions.

The instructors assessed the effectiveness of this approach to quizzing by soliciting student feedback, by looking at course failure rates, and by analyzing its effect on end-of-course evaluations. Some of the feedback from students came via a survey that asked about their

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preparation in courses without quizzes, as compared with how they were preparing for this course. In courses without quizzes, 45 percent of the students reported that they used the text as a reference only when they needed help completing homework assignments. Fifty-two percent said they finally got around to reading the text, but not until they were preparing for the exam. Use of quizzes in this class caused 85 percent of the students to agree that they came to class more prepared than they would have had there been no quizzes; 85 percent to agree that the quizzes helped them keep up with readings; and 82 percent to say that they appreciated the discipline imposed by the daily quiz routine. Failure rates from eight sections previously taught without quizzes and from nine sections with the quizzes resulted in a small but statistically significant decrease. And the course and instructor evaluations showed no adverse effects from the use of quizzes.

There are several noteworthy aspects of this article worth mentioning. First, it illustrates the kind of careful, deliberate thinking that should go into the use of any instructional strategy. These instructors know why they are using quizzes, what they hope they will accomplish, and why those goals are important and relevant to students learning introductory accounting. Second, it's a great illustration of how even small design features can change the nature of a learning experience. These quizzes are less punitive and more positive. They give students reasons to do the reading rather than punishing them for not doing the reading. That's a small but significant difference. Evidence included in the article shows how effectively this quizzing mechanism achieved the instructors' goals and garnered positive student endorsement as well.

Reference: Braun, K.W. and Sellers, R.D. (2012). Using a "daily motivational quiz" to increase student preparation, attendance, and participation. *Issues in Accounting Education, 27* (1), 267-279.

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Formative Assessment: The Secret Sauce of Blended Success

By Oliver Dreon, PhD

A few weeks ago, a colleague emailed me about some trouble she was having with her first attempt at blended instruction. She had created some videos to pre-teach a concept, incorporated some active learning strategies into her face-to-face class to build on the video, and assigned an online quiz so she could assess what the students had learned. After grading the quizzes, however, she found that many of the students struggled with the concept. "Maybe," she wondered, "blended instruction won't work with my content area."

When I met with the colleague, it was clear from our conversation that she hoped a blended approach would allow her to incorporate more active learning strategies into her face-to-face class. She wanted to break away from a primarily lecture-driven environment and provide students with more opportunities for collaboration and interaction. When we discussed her blended lesson, however, she focused mostly on what she wanted the students to learn during the different phases of the lesson. "What," I asked, "were YOU learning from your students during the different phases of the lesson?" She seemed puzzled by the question, which provided a great entryway for discussing how formative assessment can contribute to blended success.

Although most people probably associate the term "assessment" with quizzes and exams, in reality these high-stakes activities represent a small subset of assessment opportunities. Educationally, assessments can be broken into two larger categories: summative and formative. Most of our experience with assessment

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usually comes in the form of summative assessment. We have our students take exams or write papers at the end of a chapter. Summative assessments are valuable because they let us know whether our students have successfully learned what we wanted them to learn. Summative assessments, however, are limited in that they provide little information to guide teaching because they usually serve as the endpoint of some instruction.

Whereas summative assessments are assessments "of" learning, formative assessments are assessments "for" learning. They help to guide instruction and provide valuable information for the instructor and for the learner. Formative assessments can help to drive instructional decision-making and allow the instructor to "take the temperature" of the class. In the discussion with my colleague, I outlined the different phases of blended learning and highlighted opportunities for formative assessment in each.

Activities for before class

In a blended class, instructors typically assign a video or some instructional content to pre-teach a topic or concept. But this also provides opportunities for formative assessment. Instructors can examine the prior knowledge that students possess before starting the lesson. This process doesn't have to involve giving students something formal. Prior to assigning the pre-teaching material, instructors can have students complete a concept map representing what they already know about a given topic, or they can facilitate a classroom discussion where students share their knowledge associated with the concept.

The specific strategy isn't as important as the information the process reveals. By assessing students' prior knowledge, the instructor discovers the starting point for her learners, which can inform how the lessons are organized and the techniques used. In a science class, this could mean helping students overcome long-held misconceptions about a topic by using more hands-on instruction. In a math course, this might mean teaching some requisite skill needed to learn at a higher level.

Assessing prior knowledge isn't the only assessment opportunity in the pre-teaching phase of blended instruction. Instructors can also assess students after they've interacted with assigned video lessons. Students can complete a handout while watching the video or take an online quiz after the fact. Free tools like EDpuzzle and Educanon allow instructors to easily embed questions at specific points during the video. The screen recording software Camtasia Studio also allows instructors to inject questions throughout a video lesson. Again, the specific strategy itself isn't as critical as the information it provides. Armed with information from these assessments, instructors can modify their in-class lessons and activities to target areas where learners have struggled after the pre-teaching phase.

Activities for during class

In this phase of the blended cycle, instructors incorporate activities and lessons to help students build on the concepts they learned during the pre-teaching phase. Maybe students are completing problems in class or discussing higher order concepts in more detail.

Like the pre-teaching phase, this phase provides opportunities for formative assessment that can help guide instruction. For instance, instructors can use clickers to assess whether students are effectively applying the concepts. This can let the instructor know when he needs to reteach a concept or open the class to some peer instruction. Even informally observing body language and facial expression can prove to be powerful formative assessments to guide instruction.

Activities for after class

In this phase of the blended cycle, students are extending their learning by applying the concepts to new situations or building on the concepts through additional instruction. These situations lend themselves to even more formative assessments. For instance, as students exit the class, instructors can ask them to submit what they felt was their "muddiest point" of the lesson. This could provide useful information as instructors create or select content to assign.

In my colleague's lesson, she had originally assigned the quiz as more of a summative assessment. After our in-depth discussion on the power of formative assessment, my colleague began to see the quiz as providing valuable information to guide her instruction and reteach areas where the students had struggled. This important shift in the purpose of assessment is critical to the success of any student-centered environment, especially a blended class.

Oliver "Ollie" Dreon is an associate professor and director for the Center for Academic Excellence at Millersville University.

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Making the Pop Quiz More Positive

By: Maryellen Weimer, PhD

There's something about the unannounced quiz that's awfully punitive, probably reinforced by the way many instructors use them. Pop quizzes occur when there aren't many students in class or when the class doesn't appear to be well-prepared. They do get more students coming to class having done the reading but students are preparing because there may be a quiz—that's different from daily preparation motivated by the understanding that regular interaction with the material helps learning.

I like the makeover B. Michael Thorne gives pop quizzes. Beginning with a name change, he transforms them into something more positive and constructive. His pop quizzes are known as extra-credit exercises (and we all know how in love students are with extra credit). His quizzes are still unannounced and still cover material students will be expected to know for the exams, but they reward students who are prepared and don't punish those who aren't. Generally given about once a week, these quizzes are worth one point, and you either get the point or you don't. Quizzes amount to less than 4 percent of the total points available in the class, and you can ace the course without getting any of this extra credit. Despite being worth a modest amount of points, the quizzes are still enough to bump some students up to the next grade level.

This approach to quizzing got "points" from Thorne's students. In response to the "what-did-you-like-best-about-this-course" questions, almost 25 percent of his students listed the extra-credit exercise.

Maybe I like the makeover because it reminds me of an approach to attendance I borrowed from a colleague. Rather than penalizing those students who don't come to class, reward those who do. In my case, I took attendance on about 10 unannounced days during the course (typically Fridays, days after a test, or days when few students showed up), and students present on those days got two bonus points.

Does it make a difference if you reward good behavior instead of penalizing poor behavior? I don't know, but it does make for a more positive classroom environment.

Reference: Thorne, B. M. (2000). Extra credit exercise: A painless pop quiz. *Teaching of Psychology, 27* (3), 204-5.

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Four Assessment Strategies for the Flipped Learning Environment

By Robert Talbert, PhD

Flipped learning environments offer unique opportunities for student learning, as well as some unique challenges. By moving direct instruction from the class group space to the individual students' learning spaces, time and space are freed up for the class as a learning community to explore the most difficult concepts of the course. Likewise, because students are individually responsible for learning the basics of new material, they gain regular experience with employing self-regulated learning strategies they would not have in an unflipped environment.

But because initial engagement with new material is

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done independently as a *preparation* for class time rather than as its focus, many things could go wrong. If students do the assigned pre-class work but don't acquire enough fluency with the basics—or if they simply don't do it at all—then the in-class experience could be somewhere between lethargic and disastrous. How can an instructor in a flipped learning environment avoid this and instead have consistently engaging and productive learning experiences for students in both the individual and group spaces?

A key to achieving this kind of environment is *assessment.* Because flipped learning is more decentralized and personalized than a traditional course design, the challenge is to have assessments that provide reliable, actionable information about student learning in the various phases of flipped learning that is as up to the minute as possible. Armed with this knowledge about student learning, instructors can provide just the right amount of support at just the right time, anytime.

Here are four strategies for flipped learning assessment that can help provide this kind of support.

1. **Start with good learning objectives.** The basic principle of backward design states that we should start by determining the learning outcomes we wish from students, determine what constitutes acceptable evidence that students have attained these, and then design specific ways of gathering that evidence. Before any good assessment can happen, we need good learning goals. When designing a flipped course or unit, careful and clear enumeration of learning outcomes will give a framework for learning activities and help students know what they need to know and where it fits in the overall scheme of the course.
2. **Employ a "frequent and small" approach**. In an ideal world, there would be a device that connects directly into students' brains that would give a continuous stream of full-spectrum data about student learning and engagement. No such device exists yet, so the next best thing is to give assessments that are short, frequent, and informative that collect these data for us. For example, classroom response systems can be used effectively to gather in-the-moment data about student learning. Short metacognitive activities, such as one-minute papers, can give a bigger picture. And don't forget that assessment doesn't necessarily mean quizzing or grading. Sometimes simply having students talk through a procedure while you observe them can give you mountains of "data" about how they are doing.
3. **Use "preformative" assessment.** In addition to the usual categories of *formative* and summative assessments, flipped learning environments have a special third kind of assessment that I call "preformative." This refers to assessments given while students are learning new material independently, before any group interaction has taken place. Preformative assessment gives a reliable idea of what students have learned before the all-important group space activities you have planned. Preformative assessments can serve not only as data-gathering opportunities but also as learning experiences. For example, in the Guided Practice model of pre-class activities (Talbert, 2014) students practice self-regulated learning strategies in acquiring fluency with new material while at the same time giving the instructor data about their attainment of basic learning objectives, in a format that is lightweight, risk-free, and welcoming to initial failures.
4. **Act on, and share, the data you collect.** The purpose of assessment is to glean information that will improve student learning. When assessment data come in—from a reading assignment, a clicker question, a one-minute paper, and so on—ask: *What does it mean, and how can this help?* In this way, the instructor takes on the role of "resident data scientist" in his or her class, converting data into information and communicating that information to his or her clients (the students) with a view toward their attaining their goals.

It is helpful to remember that the word "assessment" comes from the Latin term ad sedere, meaning "to sit down beside." When we assess, it should be as if we are pulling up a chair next to individual students, getting down on their level, and putting ourselves in their corner to give them information that will help them succeed. In a flipped learning environment, the structure of the class puts students in a position to learn in improved ways, but it's assessment that opens the way to success.

Reference:

Talbert, R. "The Inverted Calculus Course: Using Guided Practice to Build Self-Regulation." Web log post. "Casting Out Nines." *Chronicle of Higher Education*, 4 March 2014. Web. 20 July 2015. http://bit.ly/1kWlBoT

Robert Talbert is an associate professor in the Mathematics Department at Grand Valley State University in Allendale, Michigan.

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A Quiz or the Hat Trick?

By Maryellen Weimer, PhD

It's a choice Susan Taft gives her MBA students. The class can choose to take a written quiz at the beginning of every class session (they meet once a week) or they can participate in an oral activity she's dubbed the hat trick.

Here's how the hat trick works. Each student's name is put on a card and placed in a hat that Taft brings to the class sessions. During the first hour of this three-hour class, two or three names are drawn from the hat, one at a time. If selected, the student talks about a concept of his or her choosing from the homework assigned for that week. The talk needs to demonstrate a level of familiarity with the relevant vocabulary and understanding of the concept. Taft engages with the student in discussing the concept: "In a gentle way, I orally quiz the selected student on the concept. I may ask hypothetical questions, request illustrations of the concept, or inquire about how it applies to case studies from the reading assignment. In essence, my approach is to lightly press the student for critical thinking and agile application of the material" (p. 93). If Taft hears that, the student gets the full 1.5 points, and the concept is then discussed further by the whole class.

Taft's students consistently select the hat trick over written quizzes, because they think it's less risky. Her grading scheme contributes to that perception. If a student comes to class and is not selected from the hat, that student receives full credit. The hat tricks combined are worth 21 percent of the course grade. If a student is unprepared for class, he or she may take a "pass" and receive no credit.

Despite students' preference for the hat trick and their ability to pick (and one would assume prepare) the concept they'll discuss, it's still anxiety provoking. Taft describes students looking on "with emotion-charged interest" (p. 93). She handles their stress with the "gentle questioning" described above and strives not to have "a poor performance become a humiliating experience" (p. 93). If a student is not doing well, she invites other students to become involved in the discussion. And if a student has selected a concept that he or she does not understand well or is confused by, but the student asks thoughtful questions about it, Taft does not consider that student unprepared, and she awards full credit.

In part, the strategy is successful because it relies on peer pressure. Students (even graduate ones) don't want to look foolish in front of their peers, so they come to class prepared. The hat trick is a highly effective way to develop students' abilities to speak on their feet, and it provides a professional-like opportunity to talk about concepts in the field. For Taft, it's a good way to ascertain how well concepts are being understood—to say nothing of the fact that she has one quiz to grade instead of many.

The strategy is not one likely to work well in large classes where the chance of being selected becomes increasingly remote. In Taft's case, her course enrolls less than 30 students. She's identified the number of hat tricks that creates a random likelihood of a student being selected once or twice during the course; if a student is selected more than that, she may take his or her name out of the hat. It's also a strategy that might be too anxiety provoking for beginning students, although it could be modified by allowing students to provide a summary of what happened in the last class period or by giving students permission to use notes to highlight the concept or a section in the reading.

Reference: Taft, S. (2016). Incentivizing students' preparation for class: The hat trick. *Management Teaching Review, 1*(2), 91—98.

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The Unquiz: An Enjoyable Way to Jog Students' Memories

By Janet Starks, DMin

This semester I stumbled on a creative teaching tool that surprised both me and my students. It turned out to be effective and enjoyable, and it was a quiz. I used the tool in a survey of church history course. Like most history courses, this one has lots of content and has tended to be lecture-heavy. I decided to set myself the goal of using as many different creative methods as I could and using at least one in each class. I was continually asking myself, "How can I teach this in a way other than lecturing?"

I hold to the philosophy in learning history that dates and details are much less significant than people and movements. This perspective was birthed when I finally realized that history was the stories of real people who, by their actions, shaped my life in our world. I don't require students to memorize dates to recite on a test and then promptly forget, but I do want them to know sequences and cause-effect relationships. I'm interested in their being able to connect past events to each other and to the present. For example, in the Church History survey course, it doesn't matter whether Johannes Gutenberg invented the movable type printing press in 1440 or 1450, and it doesn't matter whether Martin Luther nailed the 95 Theses to the church door in 1517 or 1527. But students do need to know that Gutenberg's press was fully functional before Luther's theses were written and that the ability to print and distribute multiple copies was a significant factor in the relatively rapid spread of the Protestant Reformation.

Having said this, in a survey course that covers 2,000 years in 13 weeks, it is necessary for us to review names, dates, and events from time to time, and to find the gaps in student information and understanding. So, at the end of the first of five units I prepared a simple, 14-question objective quiz that included the main names and events we had covered. I needed to revisit the high points of the unit.

When I distributed paper copies of the quiz there were the usual groans, especially since no quizzes had been described in the syllabus or given in previous classes. However, when I started giving the instructions, the groaning stopped. Students were to complete the quiz working in pairs, and they could use their notes. I would not collect or grade the quizzes. Suddenly the classroom changed. Instead of complaining, there was animated conversation. Students lit into the project with enthusiasm, trying to guess the answers, scrolling through their notes to find the ones they didn't know, and reminding each other of details associated with the topics on the quiz. After a few minutes we reviewed the answers. There were cheers for correct answers and sighs for wrong ones, especially if students had disagreed with their partners on the answer. At the end they quickly totaled their scores and eagerly shared with their classmates how well they'd done.

I was amazed! Without fully thinking it through, I had discovered an enjoyable way to refresh the students' memories about the significant material in the unit—twice. They reviewed the material as they answered the questions, and then again when we corrected their answers.

On the spot, I labeled this activity the "unquiz." The idea worked so well, we used an unquiz at the end of each of the next three units. Each of those quizzes contained between 15 and 20 questions (determined by how many I could fit on a single sheet of paper), and they were greeted with equal energy. At the end of the semester I asked students to complete an anonymous survey about the impact on learning of the various methods I had used; 65 percent of the class members said the unquiz had helped them learn.

Virtually all of us who teach agree on the need for assessment. It helps us know whether students have mastered the material and the skills associated with it. However, as tests grow in importance, more students struggle with test anxiety. For most students, some anxiety serves as a motivator to prepare; for others, test anxiety is crippling. Although brief objective quizzes are not necessarily good indicators of learning and usually measure only a student's ability to memorize and

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regurgitate, in this application they served as a refresher and a talking point without the influence of test anxiety. Students discovered for themselves what they didn't know rather than its being shown to them by a letter or numerical grade.

And so the unquiz will remain as part of my teaching toolbox. Like every other teaching tool, it will need to be used with care and not overused, but it seems worthy of repetition.

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Online Quiz Formats: Do They Matter?

By Maryellen Weimer, PhD

Use of online quizzing continues to grow. If taken online, quizzes don't consume valuable class time. Grading occurs automatically and doesn't consume valuable teacher time. Students get feedback immediately. The technology also offers a variety of format options. But do we know anything about how these various quiz formats affect learning? We don't know much and so far the research offers an array of mixed results. But a recent study finds that format does make a difference.

Students in this study (a sizable cohort) were enrolled in one or two semesters of an introductory undergraduate physiology course at the University of New South Wales. Starting in 2009 a quizzing component was introduced in the course, and during the next three years it was used in the four different formats described below.

1. Three quizzes, each worth 5 percent of the grade, taken without supervision, with the use of notes and textbook discouraged, each 10 questions and each completed in 20 minutes with only one try
2. Three quizzes, each worth 5 percent of the grade, taken with supervision, no books or notes permitted, each with 10 questions and each completed in 20 minutes with only one try
3. Two quizzes, each worth 7.5 percent of the grade, taken with supervision, no books or notes, each with 15 questions and each completed in 30 minutes with only one try
4. Five quizzes, each worth 2 percent of the grade if the score was higher than 90 percent, taken without supervision, open book, with more questions, no time limit and unlimited tries

"Cohorts of students undertaking the courses in which quizzes were offered in the format of models 1-3 did not demonstrate any significant overall improvement in learning outcomes as measured by performance in the summative end-of-session examinations. In contrast, the implementation of quizzes in the format of model 4 … was associated with a significant improvement in mean summative end-of-session examination scores." (p. 196) The research team offers this larger conclusion at the end of the article: "Our study supports the notion that in order for online formative assessments to be effective, they must be perceived by students to be relatively low stakes and allow exploration of existing and expected knowledge in a nonthreatening environment." (p. 199)

There was also a strong correlation between quiz scores obtained in all four formats and scores on the final exam. Students who did well on the quizzes did well on the final, and students who did poorly on the quizzes did poorly on the final exam, often failing it. On the basis of this correlation, the researchers suggest that teachers could use quiz scores to identify those students needing extra help and seek to intervene with them while there is still time for those students to make changes that could improve their overall performance in the course.

Students in these two sequenced courses appreciated the use of quizzes. Sizable majorities said the quizzes guided their study for the exams, helped them learn the content, provided feedback on their learning, and were challenging and valuable overall. A student who took the quizzes in format 4 wrote in response to an open-ended question, "Excellent revision tool. I would read over the lectures first, then attempt them first time under exam conditions—then redo them with material." (p. 195)

Reference: Marden, N.Y., Ulman, L.G., Wilson, F.S.,

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and Velan, G.M. (2013). Online feedback assessment in physiology: Effects on students' learning experiences and outcomes. *Advances in Physiology Education, 37* (2), 192-200.

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Ungraded Quizzes: Any Chance They Promote Learning?

By Maryellen Weimer, PhD

Faculty rely on quizzes for a couple of reasons. They motivate most students to keep up with their class work and, if they're unannounced, they motivate most students to show up regularly for class. The research on testing offers another reason, something called "the testing effect," described as "the phenomenon in which people appear to retain more information about a topic if they are tested on that topic and engage in memory retrieval of topic information than if they simply reread or study that information." (p. 174) It's the idea behind practice tests. If you've retrieved the information once that increases the chance that you can retrieve it again. So, if students do practice exams, their scores on the real exams improve. The caveat: most students aren't terribly motivated to do practice exams. They'll carefully review old exams and memorize the answers to those specific questions but that's very different than retrieving recently learned content.

And there's another caveat, and it has to do with student anxiety. Quiz questions promote the kind of retrieval that results in what's called test-enhanced learning. If the exam contains questions about content that appeared in quiz questions, students are more likely to get the exam question correct than students who haven't seen the material in a test question format. The problem is test anxiety and unannounced quizzes promote a lot of anxiety in some students. Those students aren't focusing on the quiz questions, they are feeling worried, unprepared, angry and otherwise disgruntled. As a result, they don't do well on the pop quiz itself and they don't reap the benefits of test-enhanced learning.

Psychology Professor Khanna wondered if ungraded pop quizzes could be used to promote test-enhanced learning for all students. She explored a number of research questions related to this issue. "First, do students retain more course information if they take periodic in-class pop quizzes through the semester than if they do not take such quizzes? Second, do students experience test-enhanced learning when completing graded and ungraded quizzes? Finally, I am interested in knowing how students feel about having quizzes in their courses and if those feelings differ depending upon whether or not the quizzes are graded?" (p. 175)

She answered these questions by looking at cumulative final exam performance in three sections of an introductory psychology course and responses to a questionnaire about quizzes. In one section there were no quizzes. In the second there were six unannounced graded quizzes, and in the third section there were the same six unannounced quizzes, but they weren't graded. Each quiz contained five multiple-choice questions and students in the quiz sections answered a six-question survey about quizzes.

As for results, the ungraded quizzes led to higher scores on the final than the graded quizzes and no quizzes. "The effect of [the] quiz condition can account for a grade level change in a students' final exam performance." (p. 177) Khanna believes, "the key to successful active retrieval practice is to ensure that students are focused on memory retrieval practice and not on emotional regulation related to test anxiety." (p. 178) Further evidence of the effects of test anxiety can be seen in student responses to the survey questions about the quizzes. "I was glad that quizzes were included in this course" generated a 5.07 mean response (on a 9-point Likert scale with 9 being strongly agree) in the graded quiz section and 6.40 response in the ungraded section. "The inclusion of

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quizzes in this course made me feel anxious about the course as compared to if there had been no quizzes" was scored 6.29 in the graded quiz section and 2.96 in the ungraded section.

However, other responses from students in the ungraded quiz section show that using quizzes this way does not solve attendance or preparation problems. Ungraded quizzes did not lead students to increase their study time nor did they improve class attendance. Could a solution be a combination of graded and ungraded quizzes?

Reference: Khanna, M. M., (2015). Ungraded pop quizzes: Test-enhanced learning without all the anxiety. *Teaching of Psychology, 42* (2), 174-178.

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Using Quizzes to Improve Students' Learning

By Tin-Chun Lin, PhD

In an instructional experiment, I split students into three groups——no quiz, announced quiz, and pop quiz. I used the same instructional style and teaching materials (including the same textbook and handouts) with each of these three groups. I also gave the same two midterms and final exam to each group. There were no mandatory attendance policies or bonuses for attendance. The announced-quiz group took 10 quizzes, each worth 2.5 percent of the course grade. The dates for these quizzes and the material they covered were listed on the syllabus. Students took these quizzes at the beginning of the class. Those absent were not allowed to make up the quiz, late students got no extra time, and late students were not allowed to complete the quiz if they arrived after students had taken it.

For the pop-quiz group, neither the schedule nor material covered on each quiz was provided on the syllabus. Students did not know how many quizzes were being given or when they were scheduled. They took their quizzes at the end of the period and, like the previous group, they had 10 quizzes, each worth 2.5 percent of the course grade. These quizzes tested students on the material covered that day in lecture. The same rules applied—no makeup quizzes for those absent or leaving early. I used different types of questions on the quizzes, including problems and short essays.

I conducted a survey and used statistics to investigate whether quizzes (pop quizzes or announced quizzes) improve students' exam performance and enhance their investment in in-classroom effort (i.e., attendance/participation) or out-of-classroom preparation. I also examined whether these different quiz types serve different instructional purposes in students' learning.

Here's what I found.

1. Student effort in class and out of class was higher, and they performed better on exams when quizzes (both the pop and announced quizzes) were given to them before they took exams. This result is consistent with other studies.

2. These two types of quizzes did not have the same impact on students' learning. (a) students' exam performance was a little better in the announced-quiz group than in the pop-quiz group; (b) students' attendance was a little better in the pop-quiz group than in the announced-quiz group; and (c) students' out-of-classroom effort was a little greater for the announced-quiz group than for the pop-quiz group.

The first result is not surprising because quizzes (either announced quizzes or pop quizzes) raise the opportunity cost of skipping class. In order to minimize grade loss

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due to missing quizzes, students need to be in class and prepared for the quizzes, which means they are studying course content more regularly. However, the second result is interesting and merits analysis.

1. Students in the announced-quiz group knew when they were having quizzes and what material the quiz would cover. Students in the pop-quiz group were not given this information. Thus, students in the announced-quiz group would probably spend a little more time studying for quizzes than students in the pop-quiz group, and this might give them an advantage over those taking the pop quizzes. This explains why students' exam performance and out-of-classroom effort were a little greater in the announced-quiz group than in the pop-quiz group.

2. Pop quizzes create uncertainty. The best strategy for minimizing grade loss due to uncertainty is to attend class regularly. Those in the announced-quiz group had certainty. Hence, students in the announced-quiz group might not attend class as often, some attending only when quizzes or exams were scheduled. This explains why students' attendance was a little better in the pop-quiz group than in the announced-quiz group.

The most important finding was that different types of quizzes serve different instructional purposes. For example, if instructors are most interested in increasing students' attendance and participation, the pop-quiz policy may be a more effective pedagogical method. Furthermore, pop quizzes promote student attentiveness. Those who leave early or don't listen in class will either miss quizzes or be unable to answer questions correctly.

The effectiveness of quizzes in promoting learning outcomes increases when the quizzes are worth a significant portion of the course grade. For instance, if the quizzes count for only 5 or 10 percent of the course grade, students may not take them as seriously, rendering the effects of quizzes on attendance, participation, preparation, and exam performance less significant.

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The Case for Reading Quizzes

By Maryellen Weimer, PhD

With most instructional practices, it's all about how they're implemented. That's what determines whether they're right or wrong. Professor Tropman teaches introductory and upper division philosophy courses. She acknowledges that there are arguments against using reading quizzes, but writes, "I have had success using quizzes in my classes." (p. 145) "For me, quizzes help set the atmosphere that I seek: one with the expectation that everyone comes to class prepared to engage with the material at hand." (p. 143)

Here's a quick rundown as to how she uses reading quizzes. Students find out about them on the first day of class. "I explain to my students that reading philosophy is crucial to learning, writing, and doing philosophy." (p. 141) Her students don't have a reading quiz every day, but quizzes happen often enough that students know they need to arrive in class having done the reading. To get students accustomed to these quizzes and to help them know how to prepare, she launches the activity with several nongraded, noncollected practice quizzes.

And she uses different kinds of quizzes. Sometimes the one or two quiz questions can be answered with a few words; sometimes answers require a sentence or two. Some days she solicits students' critical reflections on the reading; other days they are asked to summarize the main points in the reading. On occasion students complete the quiz in pairs or in groups. Some days the quizzes are open-book. A handful are even take-home. If the reading is particularly challenging, she may give students a reading question with the assignment. If they come to class able to answer that question, they will do well on the quiz question.

She underscores the importance of the reading by making the quizzes worth 20 percent of the grade in the introductory course and 15 percent in the upper division course. She does give partial credit for answers, but no

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credit for an answer that indicates the student has not read the material or has only skimmed it. Makeups aren't allowed, but the lowest two quiz scores are dropped at the end of the course.

Reading quizzes in these courses garner a range of benefits. Students come to class and on time, as the reading quizzes are the opening activity. As they wait for class to begin, students are reviewing the reading and talking about it with each other. "Not surprisingly, since many students come to class already familiar with the text at hand, and having thought about the reading, class discussion is much more fruitful and lively." (p. 141)

This article is exceptional in that Professor Tropman deals with the arguments against quizzing. She describes them in detail, including quotations, and then she responds—with reasons and accounts of her own experiences. For example, some have argued that regularly quizzing fosters antagonistic relationships between the teacher and the class. Students become resentful. Professor Tropman admits she shared this concern the first semester she used quizzes. "Yet, rather than facing a class revolt, I found students are grateful for quizzes." (p. 143) And the data she collected from students in both courses confirms this. Of the students surveyed, 89 percent reported a very positive or somewhat positive overall opinion of the quizzes. Did the quizzes encourage them to do the reading? Eight-five percent said they did so at a high or moderate level. Undoubtedly, the way Professor Tropman administers the quizzing activity contributes to this positive response.

Perhaps the most compelling argument against reading quizzes is that they motivate students to read for the wrong reasons. They are reading to get the quiz points, and that contributes to grade-oriented attitudes rather than learning-oriented approaches. Professor Tropman recognizes the validity of the argument but suggests that quizzes might increase intrinsic motivation. "To the extent that quizzes help improve one's reading skills, reading will become less frustrating, as well as more enjoyable, rewarding, and stimulating." (p. 144) And then this point: "Once students are able to see a real connection between the day's reading and classroom discussion, difficult texts can become less foreign and more accessible." (p. 144) Maybe students would need less "force" to do the reading if they understood how much reading (in most courses) promotes their understanding of the course content.

It's a well-written article that underscores how teaching strategies are not definitively right or wrong. How well they work depends on how they're used. In this case the professor includes many quiz features that promote learning and engagement. She also includes components that lessen the anxiety students often associate with testing situations. Success of instructional strategies also depends on the context in which they're used. As one of Professor Tropman's students candidly observed of the philosophy course, "I can't see how this class would function without the reading quizzes." (p. 143)

Reference: Tropman, E. (2014). In defense of reading quizzes. *International Journal of Teaching and Learning in Higher Education, 26* (1), 140-146.

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The Testing Effect and Regular Quizzes

By Maryellen Weimer, PhD

The "testing effect," as it's called by cognitive psychologists, seems pretty obvious to faculty. If students are going to be tested on material, they will learn it better and retain it longer than if they just study the material. And just in case you had any doubts, lots of evidence has been collected in labs and simulated classrooms that verifies the existence of this testing effect. But as with much of the research done in cognitive psychology, it has not been studied much in actual classrooms, and of specific interest here, in college classrooms. When it has been studied in college classrooms, the results aren't as consistent as might be expected, but then the study designs aren't all that similar.

The use of quizzes offers a good arena in which to

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study the testing effect. Students are regularly tested on course material, and that repeated testing should improve their exam and final scores. However, design details may influence the outcome. How many quizzes would students need to take to gain the testing effect benefit? Does it matter if the quizzes are announced or if they're pop quizzes? Should the quizzes be graded or ungraded? If graded, does it matter how much they count? Is the testing benefit present if the quiz questions come from material covered in class? What if the quiz questions come from assigned reading before that material is covered in class? Does the testing effect apply to certain kinds of questions but not others—say, test questions that are the same as the quiz questions, or similar to the quiz questions, or totally new questions?

What we really need here are a set of best practices—those design details that most reliably achieve the desired results. The caveat, of course, is that any set of best practices in the teaching and learning realm are the ones that usually work best. With different student cohorts learning different content from different teachers at different kinds of institutions, there are too many variables to expect consistent results. Best practices have value in that they offer a place to start.

A recent study of quizzing in introductory level psychology courses explored some of the questions regarding the design details of a quiz strategy. In the control section, each class session had a designated topic and assigned reading pertaining to that topic. Some of the reading material was discussed in class, and some was not. The instructor regularly encouraged students to keep up with the reading.

In the experimental section, students had the same content schedule and reading assignments, but they had a quiz every class session. The quizzes included two multiple-choice questions from content covered in the previous session and three questions from assigned reading not covered in class. The quizzes were graded and counted for 25 percent of the final course grade.

Both sections took three exams, and each of those exams included 15 questions from the assigned readings (plus other questions unique to each class). Some of those questions were the same questions used on the quiz, some were similar, and some were entirely new questions.

The quiz section "scores were significantly higher than the control class" (2017, 21), and they were higher on all three types of questions. A survey of students in the quiz section also revealed that anticipating daily quizzes helped the students study more, encouraged them to read more, reduced the amount of cramming, and prompted students to change their study habits.

Another study referenced in this research found the presence of the testing effect for ungraded quizzes but not for graded pop quizzes. These researchers wonder if the predictability of a quiz every class session reduced the anxiety associated with always wondering if today was going to be a quiz day.

This research doesn't answer all of the quiz design questions, but it does address some of them. And although these answers may not be definitive, they illustrate how the details of an instructional approach, such as using quizzes, can be explored empirically. Cognitive psychology has validated the testing effect. Classroom research like this begins to identify the details that make it work reliably in actual teaching situations.

Reference: Batsell Jr., W.R., J.L Perry., E. Hanley, and A.B. Hostetter. 2017. Ecological validity of the testing effect: The use of daily quizzes in introductory psychology. *Teaching of Psychology 44*(1): 18—23.

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