Crafting the Question:
Get the Most Out of Your Student Response System
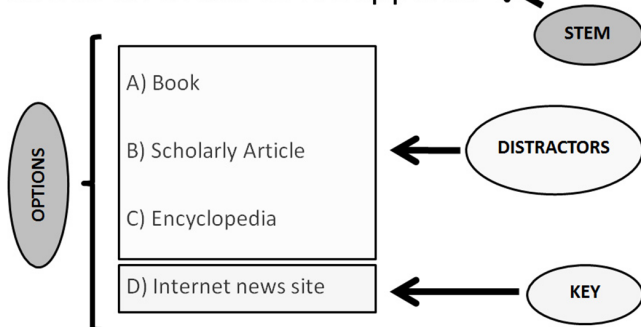
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Student response systems (SRS) are a mature classroom technology used in many universities. They can be free online—such as Socrative, Kahoot, and Poll Everywhere—or purchased and installed onsite, like the i>clickers system. In the classroom, they increase student engagement, provide an efficient means of formative assessment, and allow all students to participate without fear of embarrassment. The effectiveness of SRS, however, is not in the technology itself but in how the instructor incorporates them into a class, and well-crafted multiple-choice questions are one key to using SRS successfully.

Components of a Multiple-choice Question

Multiple-choice questions have their own vocabulary (see Figure 1). The question itself is called the *stem*, and the potential answers are the *options*. Options are made up of the *key*, which is the correct answer, and the *distractors*, which are the incorrect answers. Each of these components requires some thought when designing a question.

Figure 1: Components of a Multiple-Choice Question

The Stem

A one-shot information literacy session usually has three to four student learning objectives, and SRS provide an effective means of reinforcing the information being taught. Questions should reflect the focus of a class by having stems that relate directly to a learning objective (McDonald, 2002, p. 88). Students should be able to read the stem and, without seeing the options, know what the question is about (Haladyna, Downing, & Rodriguez, 2002, p. 312; McDonald, 2002, p. 92). Stems should be created using language that is simple and direct—avoid

library jargon and excess words that might obscure the meaning of the question. Most research on multiple-choice questions also recommends avoiding the use of negatives, such as NOT or EXCEPT, when constructing stems (Haladyna et al., 2002, p. 312). For example, instead of "Which of the following media do you *not* need to cite?" the question could be rephrased as "One of the following media does not need to be cited. Which one?"

Stems are commonly presented in three formats: question, completion, and instructional (McDonald, 2002, p. 88). Questions are self-explanatory: "What is a resource that has details about an event as it happens called?" Completion stems require students to be able to correctly identify the missing component: "A resource that has details about an event as it happens is called…" Stems can also take the form of instructions: "Choose the resource that has details about an event as it happens."

The Options

After writing the stem, write the correct answer (McDonald, 2002, p. 90). It is important to create the key first because the distractors should be modeled on how it is constructed. It is best if distractors are the same length as the key and reflect its content and grammar. Distractors that are dramatically different in length or context signal to students that they are incorrect and aid in students' guessing (Burton, Sudweeks, Merrill, & Wood, 1991, p. 20). It seems self-evident that there should be only one right answer, but it is possible to write distractors that are inexact enough to be partially correct. Make sure the key is distinct, unless the purpose is to have students choose the best among similar options.

Distractors should be plausible (Haladyna et al., 2002, p. 319; McDonald, 2002, p. 107). A good approach is to incorporate common misconceptions students have about the subject (for example, when a certain search technique can be applied and when it cannot). Most research recommends avoiding "all of the above" and "none of the above" as options (Haladyna et al., 2002, p. 319). Some researchers say to keep an open mind, but most say it reduces students' ability to discriminate in their answers. In general, it is best to use caution when choosing one of these phrases as a distractor. Finally, vary the placement of the key. It is easy to fall into the habit of placing the right answer always under B.

A frequent question is, "How many options are enough?" The number of desirable options for a multiple-

choice test has been studied more than any other guideline, and the consensus is that three options are sufficient (Haladyna et al., p. 318). The effort of developing a fourth option is probably not worth it, and some researchers have reported greater reliability—greater consistency in results—with fewer options. There is another, more pragmatic consideration and that is the size of the classroom and the resolution of the projector being used. The fewer the options, the larger the possible font size, which improves readability.

Levels of Learning

Multiple-choice questions can be written to reflect the first four levels of the Revised Bloom's Taxonomy: remember, understand, apply, and analyze (Krathwohl, 2002). The most basic level, remember, simply requires students to recall a term. For example:

The library service that allows you to borrow material from another library is called:

A.   Interlibrary Loan

B.   GetText

C.   ScholarWorks

The understanding level means students must know enough about a term or a concept to identify an example of it. For instance:

What is an empirical study?

A.   An article that surveys the current literature on a topic.

B.   An article that provides an analysis of previously published statistics.

C.   An article that is based on observed facts or behaviors rather than theory.

The application level requires students to use a concept and apply it to a particular situation. For example:

Which of the options below is an academic journal article citation?

A.   Gladstein, M. R. (2000). *Atlas Shrugged: Manifesto of the mind*. New York: Twayne.

B.   Gladstein, M. R. (2000). Atlas Shrugged: Manifesto of the mind. *American Communist History*, *(9)*1, 104-106.

C.   Gladstein, M. R. (2000, April 2). Atlas Shrugged: Manifesto of the mind. Retrieved from http://randfans.com/2007/04/atlas_shrugs_ba.html/

The fourth level, analysis, requires students to make connections between concepts. The question below requires students to connect the technique of truncation with the concept of how Boolean operators function to determine which search strategy is going to provide the best results:

Which of the following searches will give the best results for this topic: *Is there a relationship between obesity and online gaming?*

A.   obesity OR online gaming

B.   obesity AND online gaming

C.   obesity AND online gam*

Question Formats

Confidence Level Questions

A question such as "How do you feel about your ability to find peer-reviewed articles on your topic?" can provide in-class feedback on how well a learning objective has been achieved (Bruff, 2016). Depending on the response—confident; sort of confident; not confident—the instructor has the opportunity to address student concerns on the spot. Also, as Derek Bruff notes, "Prompting students to assess their confidence can also aid in metacognition–learning about one's own learning" (2016).

Another approach is to ask a traditional, content-based question and—before revealing the correct answer—follow it up with the question: "How confident do you feel about the answer you just gave?" Having a one-two question pair like this has the effect of having students think again about the content and enhances the impact of the first question.

Student Perspective Questions

Student perspective questions gather information on demographics, opinions, or experiences (Bruff, 2016). These questions can be straightforward: "How many library research classes have you had?" They can also raise topics to provoke discussion, such as "Is copying a graph or a chart considered to be plagiarism?" These questions can also be more personal and are a good technique for gauging the skill level and the emotional temperature of a class. For example:

Doing research in the library databases makes me feel?

A.   Anxious

B.   Nothing special

C.   Exhilarated

Assessment Questions

Multiple-choice questions can be used at the end of an instruction session to determine if the class met the students' needs. The question below gauges whether topics were covered to the students' satisfaction.

I would have liked to spend more time on how to:

A.   Search PsycINFO

B.   Use RefWorks

C.   Search the library catalog

D.   None of the above. I feel ready to research.

Choose Your Own Adventure Question

Choose Your Own Adventure is a good format for engaging students. For example, present students with an ethical dilemma: "Your roommate asks if she can turn in a paper you wrote last semester for an assignment she's *really* behind on. What do you say?" Students can choose "yes" or "no," and the instructor follows up their vote by clicking on internal links that go to another part of the presentation depending on the answer chosen (Bruff, 2016). There students can see the result of their decision. This provides students with a sense of control and involves them directly in the instruction.

Picture and Video Question Formats

A picture is worth a thousand words, and images will often be retained better than descriptions. Instead of written choices, options can take the form of icons or screenshots. Stems, too, can be based on the screenshot of a particular search strategy. Videos can be embedded in PowerPoint presentations and can easily be included in some of the free polling software available, such as Kahoot. Using videos helps to capture students' attention and break up an instruction session. Short videos of database or library catalog search strategies can be used to help students by reinforcing the techniques to which they have been introduced.

Time Challenges

Using SRS take time within the class session and when preparing for a class. As discussed, creating effective questions takes thought, but the process can be shortened by using students' common misconceptions as a foundation (Bruff, 2016). Reviewing examples of multiple-choice questions available online and in articles written about using SRS can also be a good way to get ideas and a sense of how to construct an effective question.

Using online resources in a class session can always present technical problems and SRS are no exception. Be sure to learn the basic troubleshooting techniques for the SRS. Practicing with colleagues is a good way to discover potential technical pitfalls and allowing more time at the beginning of class to test a system can prevent problems in advance.

Student response systems do take time during a class session and lesson plans must be adapted accordingly. Begin by including only one or two questions in a session. This will provide a baseline for how long a single question will take, providing a metric for how more questions could impact a class session. Also, when going through a class redesign, keep in mind that, although SRS questions take time, it is quality time because students are directly engaged with the material.

If using handheld clickers, decide in advance how to distribute and collect them. This is especially important if scheduling back-to-back classes with another instructor. One possibility is to have students pick them up as they enter class and drop them off at the end. It is also possible for the instructor to distribute and collect them.

If a check for understanding is done in a presentation and students do not answer correctly, the instructor needs to make a decision on how to use the remaining time in class. This is called just-in-time or contingent teaching. How to proceed depends on several factors: the importance of the learning objective, the number of students who responded incorrectly, and the time left in the session. Revisiting a topic can provide an opportunity for peer-to-peer teaching: ask students to pair-and-share and discuss why they chose the answer they did. Pose the same question a second time and see if their score improves. If not, move on to a class-wide discussion. With just-in-time teaching, instructors must have confidence in their own subject knowledge and sense of timing. It may also not be possible, if a certain number of learning objectives must be covered and there simply is not time.

Best Practices

The University of Wisconsin debriefed their faculty after launching SRS in their classrooms. These are some of the best practices they shared (2016):

- Before implementing SRS questions in your session, **make the commitment**. Using SRS requires time— they should not be viewed as add-ons to a current class outline. Instead, the class outline will need to be retooled to incorporate the use of the SRS.

- The **timing** of SRS questions is important. Plan on using three to four questions at 10-20 minute intervals in a 50-minute class session. This is a rule of thumb, and if some of the questions are simply student demographic questions (for example, "How many library research classes have you had?"), more questions can be included.

ing and exploring than experts, who by contrast read about and analyze problems up front, then plan, explore, and verify. The takeaway from this activity was that the more students become aware of how research works and how they think about and conduct it themselves, the more expert-like they may become.

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For more information about the conference, and the PowerPoints and handouts for many of the sessions, including from all the sessions listed in this article, visit the website at
http://www.loexconference.org/2016/sessions.html

- **Troubleshooting** is a time challenge, and it is also a best practice. Know how to fix the most common technical problems that arise. Always have a backup plan if the SRS fails so the instruction session is not disrupted.

- When starting out with SRS, have **low expectations**. Begin by incorporating one to two questions in a session the first semester. In the second semester, modify your lesson plan to include more.

A fifth best practice comes from the Carl Wieman Science Education Initiative (2009, p. 20). Their research on SRS concluded that, on average, 30 seconds to a minute gives students time to process a question and respond. This timing depends, of course, on the complexity of the question. When about three-fourths of the students have responded, it is often a good time to ask "Any more votes?"

Conclusion

Student response systems have become commonplace, but when coupled with well-crafted, targeted questions, this technology can help keep library instruction fresh and students engaged. It is important to remember, however, that SRS are just another teaching tool. Technology should always come second to pedagogy, so when using them, the learning objectives for the class must be the guiding force.

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