Johnson (*Research & Education Librarian*) Virginia Commonwealth University [Richmond, VA]

TUNE UP YOUR PEDAGOGICAL QUESTIONS FOR EFFECTIVE USE OF CLASSROOM RESPONSE SYSTEMS

EMILY M. JOHNSON

INTRODUCTION

In higher education, the utilization of the Classroom Response System (CRS) has grown rapidly in the last decade. A CRS "allow instructors to rapidly collect and analyze student responses to questions posed during class" (Bruff, 2009, p. 1). The use of CRS has been employed in many library instruction sessions to create a more active learning session but the efficacy is dependent on the questions used. CRS use should have an explicit pedagogical purpose consistent with meeting the session's learning objectives, increasing engagement, and assessing students throughout the session. Developing these questions is a challenge worth the effort for the interactivity and assessment components they provide. During the interactive LOEX 2013 session, "Tune up your pedagogical questions for effective use of Classroom Response Systems," participants had the opportunity to review both appropriate questions to meet learning outcomes and the types of CRS available, along with how they are currently being used in instruction.

WHY QUESTION?

We do not know students' previous experiences and we want to engage them with the content as much as possible. Questioning allows students to interact with the content presented and instructors to assess students' learning. Through this questioning, rich and unique teaching moments happen. This process can be done with or without a CRS.

Questions can be deliberately created to aid and increase learning. To develop more effective questions, the instructor needs to prepare questions dependent on sound learning outcomes. A learning outcome is a statement of what students will learn in a class session. These statements focus on student learning rather than instructor teaching (Abilene Christian University, n.d.). They include a stem (who), a verb phrase (what) and a product (deliverable). The "who" are the class attendees. The "what" can be a verb from Bloom's Taxonomy of Education Objectives which reflects cognitive skills. The "deliverable" can be the question response. Ideas for learning outcomes can come from traditional sources like the ACRL Information Literacy Standards, AAMC Medical School Objectives Project or other standard discipline-based objectives (Association of American Medical Colleges, 2013; Association of College and Research Libraries, 2000).

QUESTION CONSTRUCTION

From our learning outcomes, questions can be formulated to aid in student engagement and assessment. There are two main types of questions for CRS use: content questions (to directly assess student learning) or process questions (to gather information from students to help shape students' interactions with each other and class content). When constructing questions, limitations of the CRS must be considered:

- Does the CRS have the ability to format multiple-choice or short response questions?
- Does your question have a single concept focused on your learning outcome?
- Do incorrect answers reflect students' most common misconceptions?

Focusing on these limitations will help when trying to write appropriate content or process questions.

Content Questions

Content questions can be constructed to directly assess student learning (Bruff, 2009). They focus on the content of the instruction session and often have a right or wrong response. Through question results, the instructor can change the

classroom dynamic and content of the class by reviewing responses from all students. Three main formats of content questions are recall questions, conceptual understanding questions and application questions (Bruff, 2009). Recall questions ask students to remember facts, concepts or procedures relevant to class. They assess students' memory, not students' understanding. Conceptual understanding questions require students to recall definitions and to understand the concepts associated with the definition. An instructor can make more effective and efficient use of class time by addressing understanding related to these concepts. With application questions, students are asked to apply their knowledge and understanding to concrete scenarios, used from real life, textbook examples or national board exams.

Process Questions

Process questions gather information from students in how they interact with their peers and course materials during a class session. Two types of process questions are student perspective questions and monitoring questions. Student perspective questions invite students to share their perspective during the lecture, helping them see the relevance of the content to their own lives. Monitoring questions allow instructors to gather feedback on aspects of the students' experience (Bruff, 2009). This type of questioning could be using the classroom assessment technique of the "Muddiest Point" or a pre-test or post-test of the instruction session.

Implementation Frameworks

After reviewing the types of questions, participants discussed implementing questions into various instructional frameworks. In higher education, the physical sciences have produced the most adaptable CRS question implementation frameworks for library instruction. Utilizing the Background Knowledge Probe strategy from Angelo & Cross's book *Classroom Assessment* Techniques along with other frameworks from Beatty's article "Technology-Enhanced Formative Assessment" and Mazur's book *Peer Instruction*, allows the instructor to gain insight into what students are learning and how students are engaging with the instructional content (Angelo & Cross, 1993; Beatty & Gerace, 2009; Mazur, 1997). During the LOEX session, these models were reviewed and strategies were presented to implement the question modalities in various library instruction settings.

Available CRS Technology

While the questions and questioning frameworks could be implemented without CRS, this educational technology has many benefits: it holds students accountable for their own learning, lowers barriers between the student and instructor, and it allows for anonymous and frequent feedback (Premkumar & Coupal, 2008). The freely available web-based CRS technology demonstrated offers instructors many features to use in their library instruction sessions to reach their learning goals. Session participants were able to explore new web-based Classroom Response Systems from the student's perspective, assessing the operation and accessibility of the products for the instructor and student.

Poll Everywhere

Poll Everywhere is a freely available CRS with the ability to respond via text message or web-enabled device. The audience was able to see how polls were customizable for the different question types used and then integrated into Microsoft PowerPoint. While it is very simple to use, Poll Everywhere lacks the ability to download student responses, limiting its usefulness for library instruction. The audience participated in two polls using Poll Everywhere:

Figure 1: Screenshot of Poll Everywhere Multiple Choice Question & Response

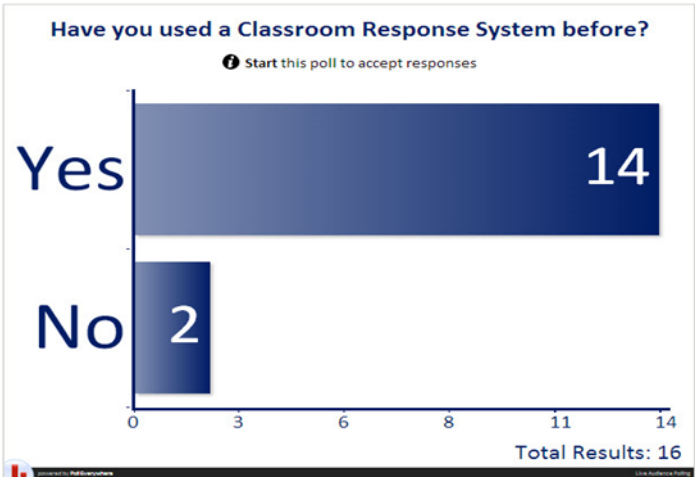
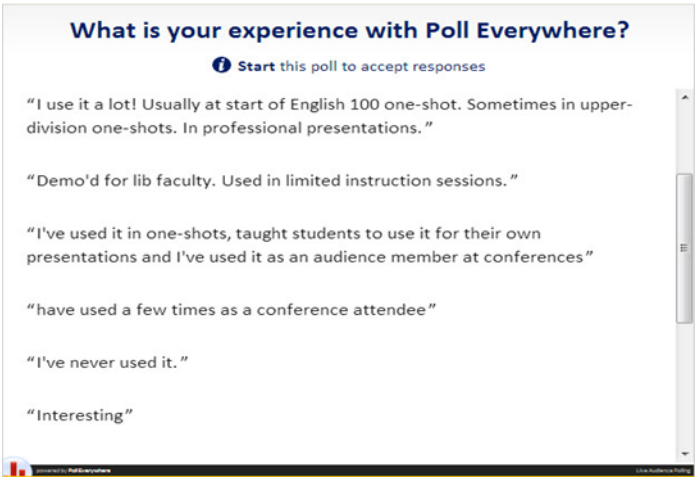


Figure 2: Screenshot of Poll Everywhere Open-Ended Question & Response

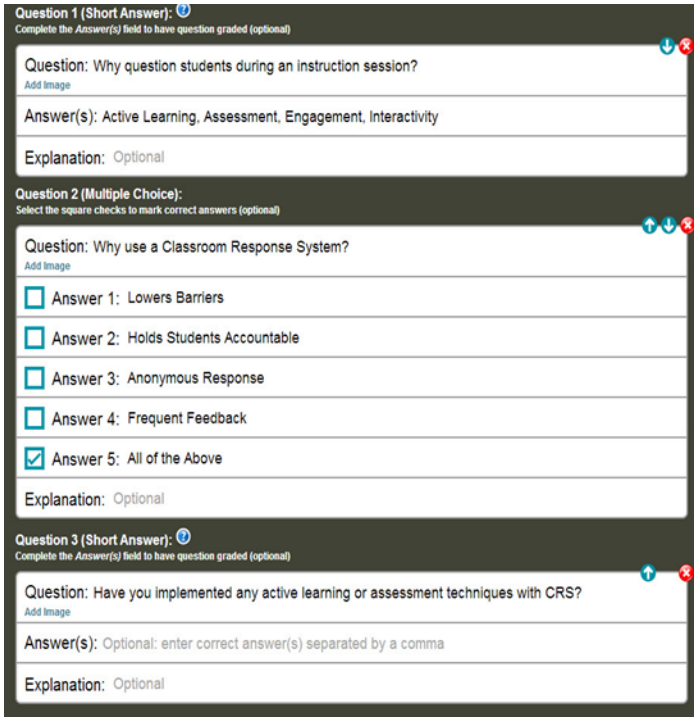


Socrative

Socrative is another example of freely available web-based CRS technology. The participants were able to access the student interface by entering an assigned "room number" via any web-enabled device. The instructor has the ability to send single questions or build quizzes to those logged in to the

room. Socrative's feature of downloadable responses makes this CRS notable for assessing student learning beyond the classroom. The audience participated in this prepared quiz:

Figure 3: Screenshot of Socrative Teacher Quiz



Mentimeter

The final freely available web-based CRS demonstrated for the participants was Mentimeter. Mentimeter is accessible through any web-enabled device. Multiple choice questions are assigned a unique identification number that audience members use to access the question. With the option of having unlimited participants, it is an ideal system to use with large lecture hall classes. The audience participated using Mentimeter with this question:

Figure 4: Screenshot of Mentimeter Multiple Choice Question & Response

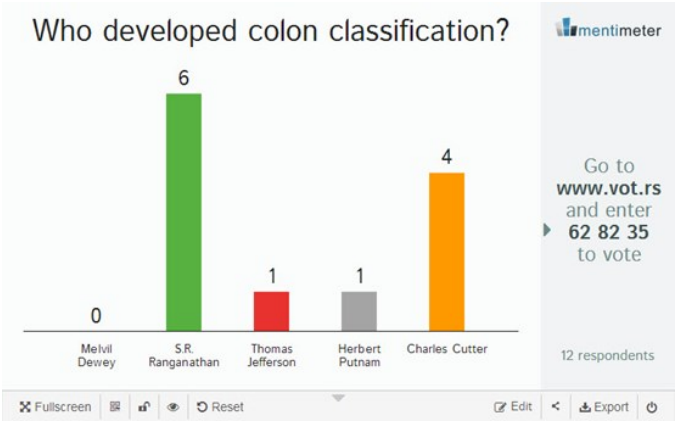


Table 1: Audiences Responses to Socrative Quiz Demonstration

Why question students during an instruction session?	Why use a Classroom Response System?	Have you implemented any active learning or assessment techniques with CRS?
To better guide your teaching!	All of the Above	Yes!
Get immediate feedback	All of the Above	No
Assessment	All of the Above	Of course!
Active learning and assessment	All of the Above	
To see how much they have learned, areas of misunderstanding.	Lowers Barriers	yes
to determine if students understand what is being covered in class	All of the Above	no
To gauge their engagement	All of the Above	Yes
Keep them engaged!	All of the Above	Yes!
So they have to engage with content	All of the Above	Yes
To get feedback, see If they are actually learning anything	All of the Above	No
To assess their knowledge.	All of the Above	No
Avoid redundant instruction	All of the Above	Not yet ...
So they will stay awake!	All of the Above	Yes, we have clickers and preloaded questions asked during the class
Capture feedback	All of the Above	Yes - as a concept check between sessions on different days.
To determine student understanding.	All of the Above	No
Real-time assessment	All of the Above	Yes

EXAMPLES

To provide more context of CRS use in library instruction, two cases were presented at the end of the session. This gave the audience members another opportunity to interact with the CRS and potentially develop ideas of implementation in their own instruction environment.

The first case involved an instruction scenario the presenter frequently conducts in her teaching. Using Socrative, a clinical health scenario with the learning outcome of "construct a well-built clinical question with PICO formatting based on a patient problem" was presented with four questions to define the four components of PICO. The audience had time to review the P – Population or Problem; I – Intervention; C – Comparison; and O – Outcome to answer the four questions. This is an essential skill for healthcare professionals so assessing this skill in an instruction session is important. This search scenario analysis could be applied to other reference question examples in library instruction by creating questions that focus on identifying keywords or subject headings.

The second presented case related to an issue in scholarly communication. The presenter plans to use this in an Honors College seminar to discuss the cost of scholarly journals. The learning outcome for this line of questioning is derived from ACRL Information Literacy Standard Five: "Identifies and discusses issues related to free vs. fee-based access to information" (Association of College and Research Libraries, 2000). Using Poll Everywhere, the following questions were asked of the audience:

- Multiple Choice – "How much money do you think the journal 'Oncogene' costs?
- Free Response – "How many people on your campus do you think read this journal?"
- Free Response – "Should the entire campus population determine the price of a journal?"

Through this line of questioning, the audience saw how a discussion could be started about the cost of scholarly materials and how the students could be more engaged in a topic which was made relevant to them.

CONCLUSION & BEST PRACTICES

This interactive session focused on the importance of pedagogy rather than learning to use CRS technology in the classroom. The CRS is a vehicle for questioning and polling during instruction and should be used with solid pedagogical foundations. Some best practices participants took away from this session included:

- The instructor needs to identify the purpose of questions by relating them to learning outcomes.
- In case of technical failure, plan to have a set of questions available so the audience can still participate by using "by-a-show-of-hands" technique.
- To stay up-to-date with your preferred CRS, follow their blog, Facebook page or Twitter account.

Participants were able to gain insight into using a CRS in a variety of library instruction. In addition, the participants were able to sample a variety of CRS technologies, as well as gain ideas of types of questions and frameworks to implement into their library instruction toolkit.

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