Audience Response Systems in Higher Education: Applications and Cases

David A. Banks
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Reviewed by Mark Werner

What are your students thinking when you are teaching? That's the question that interests the authors contributing to *Audience Response Systems in Higher Education: Applications and Cases*, an edited volume that will be of interest to faculty members who seek to teach with audience response systems (ARSs) or personal response systems (PRSs) and to academic technology support staff in higher education. (You might know of ARSs as "clickers" or "zappers.") Professors who use ARSs hope that giving students the ability to provide feedback in real time will help them learn more, and learn more effectively.

Although ARSs frequently employ handheld remote units, they sometimes employ networks of laptop computers, personal digital assistants, cell phones, and even group decision systems. The chapters of the book describe a variety of ARSs. Early systems include the ClassTalk I and II systems, while more recent systems include eInstruction, TurningPoint, IML, EduCue PRS, KEEPad, ClassInHand, and Teamworker GSS.

David Banks divides his volume into three sections: one on the historical context of ARS use, one presenting case studies of clicker use, and one describing directions for further clicker development. The historical section describes ARSs employed by the U.S. Air Force as long ago as the 1950s; by Stanford University and Cornell University beginning in the 1960s; and by IBM in the 1980s. Early ARSs employed wired response units at students' desks. Eventually the systems used wireless handheld devices, which were widely adopted in the 1990s. In one chapter, Eugene Judson and Daiyo Sawada examine research on early ARSs and find there were often no significant differences between those who used ARSs and those who did not. They offer the advice that simply using a technology in class doesn't mean the students are more active or involved in constructivist learning.

Most of Banks's volume is devoted to 16 case studies describing ARS use in courses as varied as computer science, engineering, economics, educational technology, humanities, law, math, medicine, nutrition, psychology, and sociology. The case studies cover a variety of approaches to ARS use, including the way they are used in a particular class, the impact on students and the classroom culture, and the importance of the questions used with ARSs. Two chapters offer methods for evaluating ARSs, and most studies conclude with recommendations for how faculty should teach using ARSs.

The most common concept discussed is developing appropriate questions. Case studies address forming good questions, deciding when to insert questions in a class, the types of questions to pose (multiple choice, partially-correct multiple choice, and free-form whiteboard responses), and understanding how to map questions to taxonomies for higher learning, including Bloom's Taxonomy and Fink's Taxonomy of Significant Learning.

Several cases offer suggestions for forming effective questions. Two case studies suggest that professors could think about forming questions with many responses (rather than the traditional four or five) because current ARS technology allows for at least 10 inputs. Studies ask whether questions should have a right answer or not. One case study suggests that perhaps the common practice of providing a single, right, multiple-choice response could be replaced by several responses, each having varying levels of correctness. One study suggests that preparing students for the ill-defined questions they will face in their careers may be an effective practice for teaching and learning. The authors suggest asking questions to "…help students to learn to reason, think defensively, and answer future questions."

Various authors describe ARSs as facilitating a variety of good teaching practices. These practices include engaging students and encouraging peer instruction. They also include facilitating diagnostic assessments, to determine a baseline for students' knowledge, and formative assessment, which allows a professor to measure students' conceptual understanding during a class. ARSs also promote constructivist methods of teaching, question-based methods, problem-based methods, and methods designed to develop critical-thinking skills. A few of the case study authors address the impact of the technology on students, including students' levels of anxiety and anonymity.

The final section of the book consists of five chapters devoted to a look ahead to future ARS development. One chapter describes how cell phones using short message service (SMS) could approximate the functions found in current ARS systems. It describes how students responded to questions in class by sending text messages that were received on a professor's laptop computer. The advantages of this system were that students already had cell phones and that the infrastructure the professor needed to receive messages was minimal.

Another chapter describes an ARS in which the professor used a handheld device to capture student responses. This system allowed the professor to freely roam around the room while using the ARS.

One chapter describes a product called Neo-slate, which allows students to use PDAs to work on a whiteboard interface anonymously. The term *Neo-slate* comes from "new slate," which invokes the image of students of years

past using chalk and slate boards at their desks and showing their results to their teachers. With the new PDA-based system, professors can capture students' work through a Bluetooth connection and display it for others in the class to see.

Probably the most interesting and different approach for the future comes from a chapter that discusses a rather low-tech response system called CommuniCubes, which are described as "...lightweight, ten-centimeter cubes, small enough to be handheld and large enough to be visible in a lecture hall seating 400." These cubes are physical objects with numbers from one to five on each of five faces. Each face also has a different color to aid in identifying a student's response. The advantages of CommuniCubes include no risk of technical failure, low cost (between $1 and $20), fast student training time (one minute), and so on. Students make their selection by showing one face of the cube, and a professor or TA counts the results. This approach, which harkens back to the colored flash cards used by some lecturers previously, may seem foreign, but sometimes basic technologies gain momentum because of their simplicity.

This volume is a useful addition to the libraries of faculty members and academic technologists. The historical section is helpful to remind readers that ARSs were part of a decades-long effort to improve professors' abilities to better understand their students' learning in class. The future-looking chapters might be most useful to academic technologists planning to support ARSs or to professors looking for different models for ARS use. The case studies could be selectively read for the disciplines they address, the ways they impact various methods of teaching, and particularly in the shaping of questions to be used with ARSs. *e*

Mark Werner (mark.j.werner@colorado.edu) is Manager of Instructional Technology Support Services at the University of Colorado at Boulder.