Livening Up the Classroom: Using Audience Response Systems to Promote Active Learning

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ABSTRACT. Audience response system (ARS) technology offers considerable promise for bringing more interactivity and engagement to the classroom. Since gaining momentum in the late 1990s, ARS use has been promoted for its ability to provide immediate feedback, focus student attention, identify gaps in knowledge, and enhance student involvement. This inexpensive technology is potentially of great value for improving the educational experience of students and instructors alike.

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INTRODUCTION

Anyone who has ever taught a large group lecture, or attended one for that matter, knows that this traditional educational format has significant limitations. Lectures seem well-suited for transmitting significant amounts of information to large numbers of people within a limited period of time. However, several factors seriously detract from the effectiveness of this teaching method. Adult attention spans start to wane after 15 to 20 minutes of sitting passively in a lecture hall. After three hours, students are able to recall only 25% of the material presented in a one-way lecture. These well-documented shortcomings of conventional lectures, along with the development of new electronic teaching tools, have prompted many to rethink pedagogical techniques and adopt innovative technologies. One idea that has generated much excitement in the academic community recently is interactive voting using classroom or audience response systems.

An audience response system (ARS) is a combination of hardware and software that enables the instructor to pose real-time questions to students. The students usually register their responses using handheld clickers, although other input devices such as laptops or personal digital assistants may be used. After receivers transmit the responses to the instructor’s workstation, the software compiles and displays the results. Trends or changes in student thinking are easily charted using histograms or percentages. Results can also be saved and analyzed using standard office programs such as Excel or Word.

The appeal of audience response systems lies in a few key characteristics: interactivity, engagement, anonymity, instant feedback, and non-threatening group participation. ARS use helps to generate lively debate and promotes peer-to-peer interaction. The technology is relatively easy to both install and use. Still, an ARS is not a magic bullet. Wood notes, “Like any technology, these systems are intrinsically neither good nor bad; they can be used skillfully or clumsily, creatively or destructively.”

This article will provide a brief history and description of audience response technology, a summary of the types of systems that are available today, and a look at ARS use in the educational environment. Pros
and cons of implementation, as well as key research findings supporting ARS use, will be covered. Benefits of ARS implementation in libraries will also be discussed.

**AUDIENCE RESPONSE SYSTEMS**

*History and Background Information*

Before educators started to discover them in the mid- to late-1960s, audience response systems were used primarily by businesses for focus groups, employee training, and meetings. The first popularly-used system in education was Classtalk, which proved to be costly and difficult to install. In the past six or seven years, companies such as eInstruction, Turning Technologies, and InterWrite have marketed a new generation of ARS systems that use proprietary clickers, handheld keypads resembling TV remote controls.

Known by a variety of other names, including student, classroom, polling or personal response systems, classroom performance or communication systems, electronic voting systems or just plain “clickers,” this technology has generated considerable excitement in the classroom. Several studies document noteworthy increases in both student and teacher satisfaction. Immediate feedback means instructors no longer need to wait until exam time to evaluate student comprehension of content. Instructors are able to make dynamic adjustments to course material and clarify points that prove to be especially troublesome. With anonymous responses, students are spared the discomfort of providing wrong answers in front of their peers and they often discover that they are not alone in their confusion.

Reports from the early 1970s were the first to describe the usefulness of audience response systems in large classroom environments. Studies lauding their benefits in both large and small classrooms have appeared with increasing frequency since the late 1990s. As West points out, “General knowledge and implementation of course-related polling appears to recently have reached the critical threshold.”

**Types of Audience Response Systems**

There are three basic types of audience response systems: infrared (IR), radio frequency (RF), and wireless (WiFi). Specific hardware requirements vary with each kind of ARS, but all require an instructor’s
computer to run the software and an LCD projector to display responses. Most response systems make use of handheld clickers with buttons for numbers, letters, or both. Audience response systems may be purchased independently or they may come bundled with textbook purchases. The majority of systems require one or more receivers. Some installations allow instructors to import class roster information.

IR systems require line-of-sight communication between the transmitters, usually hand-held clickers, and the receiver(s). The ratio of transmitters to receivers varies from 40:1 to 80:1. Some signal interference may occur with IR systems, and electrical wiring requirements are often complex in large settings. However, IR systems are often preferred, due to their history of superior reliability and performance.

Since RF systems are not dependent on line-of-sight transmission, signal transmission is generally more reliable than with IR-based systems. One RF receiver is able to accommodate reception from about 500 input devices. The cost of RF clickers is higher than those used with IR systems.

WiFi audience response systems usually work with existing wireless campus networks and use laptops or PDAs for input. The most sophisticated WiFi systems on the market utilize server-based software distribution.

Pros, Cons, and Best Practices

Many reports of educational experiences with audience response systems contain upbeat testimonials touting a variety of improvements. Lectures are often transformed into animated, active learning experiences. An ARS can be used to generate discussion and encourage collaboration, stimulate widespread student participation, elicit diverse points of view in a non-threatening manner, enhance retention of material, assess student learning on a real-time basis, measure student attitudes, improve class attendance, and add a tone of drama and excitement to even the largest lecture classes. The Center for Teaching and Learning at Vanderbilt University has compiled a bibliography of research articles examining the effectiveness of classroom response systems.

As with all technologies, problems of a technical nature may occur. Cost may be an issue, especially if radio-frequency clickers are used with large groups of students. Beyond the expense and possible technical problems, the use of an ARS requires changes in teaching style and course planning. Adding time for ARS-based questions means less planned lecture time. As El-Rady reports, “On average, a good concep-
While an ARS is relatively simple to install and to implement, successful use depends on a number of factors. Robertson offers practical, pragmatic tips for effective use: allow sufficient time to test the system for potential technical difficulties; keep questions clear, short, and focused; and encourage active discussion, which is usually one of the most valuable outcomes of ARS use. Duncan suggests keeping the level of questioning at an intermediate level, emphasizing questions that enhance critical thinking, conceptual understanding and active learning. Optimal ARS use also involves following fundamental educational practices, such as setting clear goals.

Types of Questions

Questions used with audience response systems usually fall into three general categories: factual recall, conceptual understanding, and knowledge application. In addition, it is possible to take attendance, administer quizzes, gather class evaluations, and solicit information on student attitudes, beliefs, and opinions. Many response systems now work in conjunction with course management software, such as BlackBoard, reducing paperwork and saving time.

Factual questions are often used to determine if students have done assigned readings or mastered key points, emphasizing memorization or recall. Conceptual questions, while more difficult to devise, tend to generate more substantive discussion and debate. Application questions entail analysis of concepts in a new context, leading to a much higher order of learning. The formulation of clear, effective questions lies at the heart of the educational challenge for successful audience response system use. As Duncan notes, “Technically, then, it is not difficult to ask questions. Pedagogically, the composition of good, thought-provoking questions has never been easy and has always been a key part of teaching science.”

KEY RESEARCH FINDINGS

The most sophisticated level of ARS utilization leads to robust interactive classroom discussion and peer instruction. Peer instruction, a concept pioneered by Eric Mazur, Professor of Physics at Harvard University, emphasizes “teaching by questioning” over “teaching by telling.” Stu-
Students are expected to investigate and review core concepts prior to the teaching session. The instructor poses questions which students start off answering individually. After preliminary results are tallied and displayed, students break into small groups to discuss responses and consider alternatives. Follow-up voting is conducted, allowing the students to consider changes in viewpoints and letting the instructor decide if further clarification is warranted. Students are motivated to stay focused and clarify their thinking and logic. Articulating their thoughts and reasoning enhances students’ ability to identify flaws and gaps in their logic and understanding. For the instructor, adjustment of classroom teaching is dynamic and based on real and immediate needs.

An early investigation of ARS use and peer instruction in the area of physics produced statistically significant gains in standardized test results. Most ARS evaluations, though, are based on self-reporting from interviews or questionnaires. These often describe improvements in levels of student interest, motivation, engagement, and satisfaction. West identified four research studies analyzing positive learning outcomes. She argues that the switch from passive to active learning is the key to success, not the specific technology or technique used.

**LIBRARIES AND ARS USE**

Librarian educators are constantly seeking ways to enhance the effectiveness of information literacy instruction. Many librarians are experimenting with a variety of new instructional technology tools and teaching methods. Beyond the choice of technologies, though, is the need to incorporate active learning techniques to motivate students to be engaged participants. Audience response systems have emerged as inexpensive, effective tools for promoting active learning. Currently, there are no published studies of audience response use for library instruction. That situation will most likely change in the near future as librarians discover the benefits of this powerful and flexible technology.

**CONCLUSION**

Audience response systems have clearly demonstrated their value in the education environment. The interactivity and engagement that result from ARS use have been amply demonstrated and well-documented. It is common for both instructors and students who have experience with
response systems to become their champions and promoters. Optimal use of audience response systems holds promise for radically enhancing learning in the classroom.

REFERENCES


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