Resident and Attending Physician Attitudes Regarding an Audience Response System

Justin W. Kung, MD[a,b], Priscilla J. Slanetz, MD, MPH[a,b], Po-Hao Chen, MD, MBA[b],
Karen S. Lee, MD[a,b], Kevin Donohoe, MD[a,b], Ronald L. Eisenberg, MD, JD[a,b]

Purpose: Audience response system (ARS) technology is increasingly being incorporated into radiology education. The aim of this study was to gauge resident and attending physician attitudes regarding the use of an ARS in resident conferences.

Methods: An anonymous survey was sent to 38 residents and 57 attending physicians to gauge their attitudes regarding the use of an ARS in resident lectures using a 5-point, Likert-type scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree).

Results: A total of 30 of 38 residents (78.9%) and 26 of 57 attending radiologists (45.6%) responded. Residents viewed the incorporation of an ARS into lectures positively, replying that they learned better from lectures incorporating an ARS (mean, 4.03; 95% confidence interval [CI], 3.74-4.32), felt more comfortable answering questions using it (mean, 4.53; 95% CI, 4.25-4.81), and were more likely to attend a lecture that incorporated its use (mean, 3.70; 95% CI, 3.37-4.03). The use of an ARS by attending physicians was limited (9 of 26 [34.6%]), with respondents citing a lack of adequate training. Those attending physicians who used it viewed the system positively, stating that residents were more engaged when they used an ARS (mean, 4.33; 95% CI, 3.87-4.79). An ARS somewhat helped the faculty members gauge resident understanding of the lecture material (mean, 3.67; 95% CI, 2.95-4.40) and prepare future lectures (mean, 3.33; 95% CI 2.68-3.98).

Conclusions: Both residents and attending physicians favorably view audience response technology as a means to enhance education in didactic and case-based settings. Increased training on how to incorporate its use into teaching may drive additional utilization.

Key Words: Audience response system, resident education

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INTRODUCTION

An audience response system (ARS) allows lecturers to actively engage learners by posing multiple-choice questions [1]. Audience members select their answers using electronic keypads, and the results are displayed on a screen in real time. This approach results in immediate feedback for both learners and teachers and permits real-time adjustment of the content and delivery of material.

Studies have shown that the integration of audience response into traditional didactic sessions enhances learning and improves the retention of covered material [2-4]. However, despite positive perceptions of the system by medical students [2] and residents in other specialties [5], the incorporation of ARS into radiology resident didactic lectures has been limited [6].

In this study, we evaluated both radiology resident and attending physician attitudes about the use of an ARS in didactic and case-based radiology resident conferences, including perceived benefits, obstacles to incorporation, and perceived drawbacks.

METHODS

This study was deemed exempt by our institutional review board. Our university-based teaching institution has 9 to 10 radiology residents in each year of training. Two 45-minute PowerPoint (Microsoft Corporation, Redmond, Washington) lectures are given daily to the residents by attending physicians using a mixture of didactic and case-based formats.

An ARS (TurningPoint; Turning Technologies, Youngstown, Ohio) has been available at our institution

[a]Department of Radiology, Beth Israel Deaconess Medical Center, Boston, Massachusetts.

[b]Harvard Medical School, Boston, Massachusetts.

Corresponding author and reprints: Justin W. Kung, MD, Beth Israel Deaconess Medical Center, Department of Radiology, 330 Brookline Avenue, Boston, MA 02215; e-mail: jkung@bidmc.harvard.edu.

Table 1. Resident responses to the audience response system survey (n = 30)

Statement	Result
I learn best from didactic conferences.	3.40 (3.09-3.71)
I learn best from case conferences.	3.93 (3.65-4.21)
I learn better from a lecture that incorporates the audience response system than from one that does not.	4.03 (3.74-4.32)
During a lecture I feel comfortable verbally answering a question I am uncertain about.	2.73 (2.29-3.17)
During a lecture I feel comfortable answering a question that I am uncertain about using the audience response system.	4.53 (4.25-4.81)
I am more likely to attend a lecture which incorporates the audience response system.	3.70 (3.37-4.03)
I would rather listen to my peers answer a question verbally than use the audience response system.	2.87 (2.44-3.30)
Seeing how my answer compares to my peers' answers using the audience response system is beneficial.	3.97 (3.75-4.19)
I believe using the audience response system will better prepare me for my board examinations.	3.57 (3.25-3.89)
What are the biggest drawbacks of the audience response system?*	
A. Do not hear my fellow resident verbal answers.	11 (36.7%)
B. Difficult to use.	1 (3.3%)
C. Lectures are not engaging.	2 (6.7%)
D. Directed questions with multiple choice answers are easier to answer than taking an unknown case.	20 (66.7%)

Note: Data are expressed as mean (95% confidence interval) or as number (percentage).
*Multiple answers allowed.

for 3 years and has been integrated into both didactic and case-based conferences by some of the attending physicians. The system is maintained by the residency program coordinator and is available to all faculty physicians. It consists of software, keypads, and a response receiver. Interactive slides are created in TurningPoint and integrated into a PowerPoint presentation.

A total of 38 residents and 57 teaching attending physicians were sent an e-mail survey regarding their attitudes toward the ARS. Anonymous responses were collected through SurveyMonkey (http://www.surveymonkey.com). The surveys consisted of statements with possible ratings using a 5-point, Likert-type scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree), multiple-choice questions, and free-text answers (Tables 1 and 2).

Statistical analysis was performed using SAS version 9.3 (SAS Institute Inc, Cary, North Carolina). Descriptive statistics (means and 95% confidence intervals [CIs]) were calculated. One-sample and 2-sample unequal variance t-tests with 2-tailed distributions were performed and significance values reported for questions evaluating comparable topics.

RESULTS

A total of 30 of 38 residents (78.9%) and 26 of 57 faculty members (45.6%) responded to the survey regarding the use of an ARS.

Residents

Respondents indicated that they learned more effectively from case conferences than didactic conferences, regardless of whether an ARS was incorporated into the session (mean, 3.93 [95% CI, 3.65-4.21] vs 3.40 [95% CI, 3.09-3.71]; $P < .01$). They felt that they learned better from a lecture that incorporated an ARS than from one

that did not (mean, 4.03; 95% CI, 3.74-4.32) and were more likely to attend a lecture that incorporated the technology (mean, 3.70; 95% CI, 3.37-4.03). Furthermore, residents felt more comfortable answering difficult questions using an ARS (mean, 4.53; 95% CI, 4.25-4.81) than answering verbally (mean, 2.73; 95% CI, 2.29-3.17) ($P < .01$). Finally, residents felt that the incorporation of an ARS would help them better prepare for board examinations (mean, 3.57; 95% CI, 3.25-3.89).

For residents, the major perceived drawbacks of an ARS were that directed questions with multiple-choice answers are easier to answer than unknown cases (20 of 30 [66.7%]) and that participants were not able to hear the verbal answers of their fellow residents (11 of 30 [36.7%]).

Attending Physicians

The attending physician respondents felt that they were not adequately trained in how to use the system (mean, 3.50; 95% CI, 3.12-3.88). They were neutral as to whether it was too time consuming to incorporate ARS questions into their lectures (mean, 2.85; 95% CI, 2.49-3.21).

Nine of 26 attending physicians (34.6%) who responded to our survey had incorporated the ARS into their lectures. They tended to be younger, and a majority were within 5 years of training. Most of these used audience response technology to review topics (44.5%) or to both introduce and review topics (55.5%). No attending physician used it solely to introduce topics. Attending physicians who had used the system generally felt that residents were more engaged when they used an ARS (mean, 4.33; 95% CI, 3.87-4.79). The ARS also slightly helped them better gauge resident understanding of the material (mean, 3.67; 95% CI, 2.95-4.4) and to prepare future lectures (mean, 3.33; 95% CI, 2.68-3.98). The

Table 2. Attending physician responses to audience response system survey (n = 26)

Statement	Result
How many years have you been an attending?	
A. 0-5 years	13/26 (50.0%)
B. 6-10 years	3/26 (11.5%)
C. >10 years	10/26 (38.5%)
The audience response system is too time consuming to incorporate into lectures.	2.85 (2.49-3.21)
I have not been adequately trained on how to incorporate the audience response system into my lectures.	3.50 (3.12-3.88)
I have incorporated the audience response system into my lectures.	
A. Yes	9/26 (34.6%)
B. No*	17/26 (65.4%)
Evaluating resident answers using the audience response system helps me gauge resident understanding of the material.	3.67 (2.95-4.40)
Evaluating resident answers using the audience response system helps me to prepare future lectures.	3.33 (2.68-3.98)
Residents appear more engaged in the lecture when I use the audience response system.	4.33 (3.87-4.79)
I use the audience response system to:	
A. Introduce topics.	0/9 (0%)
B. Review topics.	4/9 (44.5%)
C. Both	5/9 (55.5%)
D. Neither	0/9 (0%)
What is the biggest drawback of the audience response system?	
A. Too time consuming to incorporate.	3/9 (33.3%)
B. Difficult to develop appropriate answers.	1/9 (11.1%)
C. Makes cases too easy for the resident to answer.	3/9 (33.3%)
D. Other	2/9 (22.2%)
	Limits content presented due to time consumed using audience response system

Note: Data are expressed as number (percentage) or as mean (95% confidence interval).
*End-survey function incorporated for attending physicians who answered no.

major perceived drawback of the ARS in this group of attending physicians was that the system was either too time consuming to incorporate into their lectures (3 of 9 [33.3%]) or that it made it too easy for residents to answer questions (3 of 9 [33.3%]), especially during case-based sessions.

DISCUSSION

Audience response technology continues to be used in medical education as a means to enhance interaction and engage learners. To date, however, few residency programs have integrated this technology into their curricula. At our institution, we found that residents were more likely to attend and learn better from lectures that incorporated an ARS and that the use of ARS by attending physicians was relatively limited, primarily because of a lack of adequate training.

Resident physicians responded positively to all questions regarding an ARS, indicating that they felt that an ARS enhanced learning and enabled them to more comfortably answer difficult questions. They also were more likely to attend a lecture incorporating an ARS. These findings are similar to a study by Nayak and Erinjeri [2], who evaluated an ARS in radiology medical student education and found that use of the system increased students' self-confidence and provided insights for future studying.

There are objective reasons as to why the ARS was received positively by resident physicians. It is known that engagement of the audience during a lecture is an effective teaching technique [7]. The ARS allows for interaction even during traditional didactic lecture formats [8] as well as immediate feedback, which is an important part of learning [9]. Although our study did not specifically address other additional benefits of the ARS, Rubio et al [3] compared radiology residents who received the same lecture with and without incorporation of an ARS and found better learning and long-term retention scores in residents who had been exposed to the ARS.

Although residents reported more engagement and improved learning when the ARS was incorporated into the didactic curriculum, only a minority (34.6%) of the staff radiologists at our institution have used the ARS as part of their lectures. These findings are similar to those of Nicholson and Bassignani [6], who reported that only 27% of their radiology faculty members had used the system. Our faculty members who did not use the system felt that although the system was not too time consuming to incorporate into lectures, they were not adequately

trained in its use. At our department, the ARS was introduced at faculty meetings, and specific tutorials were given during sessions devoted to faculty career advancement. Therefore, there is a continuing need for ongoing training and support to encourage broader adaptation of this technology into resident teaching.

Among those attending physicians who did incorporate the ARS, feedback was positive. Similar to the study of Nicholson and Bassignani [6], attending physicians felt that residents were more engaged and that the ARS helped faculty members gauge resident understanding of the material and prepare future lectures.

The majority of attending physicians who did incorporate the ARS into lectures were recent graduates, within 5 years of completing training. This suggests that younger attending physicians, who are more likely to be technologically savvy compared with their more experienced counterparts, will be more willing to adopt this system.

The major drawback of the ARS for both residents and attending physicians was that focused multiple-choice answers made it easier for residents to answer the questions and did not require as much creative thought and synthesis as when the system was not used. The inability to hear fellow resident responses is an additional drawback. However, residents believed that the multiple-choice format of the ARS was useful for preparing for written board examinations and also encouraged a greater degree of participation. Lectures that strategically incorporate a mixture of both audience response and traditional verbal questions may represent a reasonable compromise without sacrificing any of the benefits of either approach.

One limitation of our study was that both resident and faculty respondents may have experienced using an ARS in settings outside of resident lectures, which could have influenced some of the survey responses. In addition, this survey was administered at a single institution, and the results may not be generalizable to other practice settings. Finally, the limited number of attending physicians who had used an ARS highlights the logistical difficulties in incorporating any new teaching technology despite being based at an academic teaching hospital.

In conclusion, attending and resident physicians who used an ARS viewed it favorably with regard to both teaching and learning during residency training. Given the relatively small number of attending physicians who used the system, future efforts should be focused on providing ongoing training on how best to incorporate this interactive technology into teaching clinical radiology.

TAKE-HOME POINTS

- Both residents and attending physicians favorably viewed audience response technology as a means to enhance resident education.
- Residents viewed the incorporation of audience response technology into lectures positively and felt that it would help with board preparation.
- A minority of attending physicians had incorporated audience response technology into their lectures, generally citing inadequate training.
- Increased training on how to incorporate audience response technology into teaching may drive additional use.

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