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The Use of Audience Response Systems in Nursing Education: Best Practice Guidelines

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The Use of Audience Response Systems in Nursing Education: Best Practice Guidelines*

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Abstract

The use of Audience Response Systems (ARS) or 'clickers' as an active learning strategy in nursing education has been steadily on the rise. ARS technology allows the dynamic engagement of students in the classroom by providing immediate two-way communication between faculty and students. ARS can be used to explore knowledge and common misconceptions, act as a springboard for classroom discussions, and can be used for testing or evaluation. The aim of this paper is to present best practice guidelines for both novice and experienced ARS technology users. A summary of the state of the research in this area will be presented. Practical application techniques and pedagogical strategies relating to ARS use are discussed, including question construction. ARS technology can enliven teaching practice and allow students to become invested and engaged in the learning process.

KEYWORDS: active learning, audience response systems, best practice

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The use of Audience Response Systems (ARS) or 'clickers' has increased in popularity as an active learning strategy for many nursing faculty. The technology, which involves students responding to questions with a handheld device, provides immediate two-way communication between faculty and students. ARS technology has broad applications in the classroom including, but not limited to student engagement in classroom discussions, testing, as well as formative and summative course evaluation.

ARS technology is designed to assist faculty in quickly engaging all learners in the classroom while maintaining anonymity and reducing the anxiety and fear involved with classroom participation activities (Collins, 2007; Zurmehly & Leadingham, 2008). This innovative technology allows faculty members to ascertain students' knowledge on a topic, explore common misconceptions, initiate classroom dialogue, survey students, and conduct both testing and evaluation (Caldwell, 2007; DeBourgh, 2008). The strategy also gives faculty a window into the learning needs of the class and allows students to become invested in the learning process.

The aim of this paper is to introduce guidelines for nursing faculty using ARS technology. Research literature in ARS usage is presented, followed by best practice recommendations for nursing faculty, including practical application techniques and pedagogical strategies for both novice and experienced ARS users.

REVIEW OF THE LITERATURE

An extensive literature review was conducted to identify published studies about ARS in higher education. The literature was derived from peer-reviewed bibliographic databases including: MEDLINE, ERIC, CINAHL, and Academic Search Complete. Foundational literature about teaching strategies from as early as 1956 was included, as well as from 1997-2010, with most ARS literature published within the last five years. One hundred and twenty-six articles were retrieved in the search using key terms of audience response systems, student response systems and clickers. Research studies, review articles, and practical teaching articles on ARS in health sciences higher education were also included. Secondary study summaries, book reviews, or ARS articles published about elementary or secondary education were excluded from the review. Thirty-eight articles meeting the inclusion criteria comprise the literature review.

Four themes emerged from the review of the literature: ARS and active learning approaches, benefits of ARS for students, benefits of ARS for faculty,

and barriers to ARS use. The research state of ARS is also discussed, and areas of agreement and disagreement in the literature are reviewed.

ARS and Active Learning Approaches

Active learning approaches in nursing education are not a new concept. Traditional lecture-based educational experiences provide considerable information to students with little interactive participation or assessment of understanding. In this environment, class-based discussions are often monopolized by the faculty member and a small handful of students wanting to share their comments or views. Bonwell and Eison (1991) were among the first to write about active learning principles for higher education. Active learning approaches dynamically involve the learner in meeting the six learning domains proposed by Bloom (1956): knowledge, comprehension, application, analysis, synthesis, and evaluation. Active learning engages students by encouraging reading, writing, discussion, problem-solving, analysis, synthesis, and evaluation of the course material. Bonwell and Eison assert that active learning strategies assist in long-term retention of course material and are more effective than lecture in developing higher order thinking skills. This is especially important in the nursing profession where critical thinking and application of theory materials in the clinical setting are paramount.

Active learning strategies may involve role-play, discussion, simulation, and peer teaching (Bonwell & Eison, 1991). Using active learning theory as a foundation, peer instruction techniques using ARS technology have been discussed in the literature as a way of engaging students. The peer instruction method was first proposed by Mazur (1997) as a mechanism for reviewing core concepts at the beginning of the class period. Peer instruction includes the following steps:

1. the faculty member poses a question using ARS technology
2. students answer the question individually using the ARS device
3. after the preliminary results are displayed, students break into small groups to discuss the concept and correct answer
4. students are asked to submit a revised answer using the ARS device
5. the correct answer is displayed and the faculty member has an opportunity to explain the rationale behind the correct answer and to address any misconceptions (Fagen, Crouch, & Mazur, 2002; Mazur).

Crouch, Watkins, Fagen, and Mazur (n.d) gathered information over a 10-year period about the effectiveness of peer instruction techniques on student

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learning. They assessed this by looking at trends in examination scores and percentages of students who answered certain exam questions correctly after peer instruction activities in class. Crouch and colleagues were able to demonstrate a statistically significant increase in test scores post peer instruction activities between the years of 1990 and 2000. They also reported an increase in the number of students answering exam questions correctly after using peer instruction techniques in class (Crouch, et al.).

There is literature to support favorable student perceptions of peer instruction techniques using ARS. Henriksen and Angell (2010) reported using ARS technology in combination with small group discussion in undergraduate physics courses with positive responses from the students. Perkins and Turpen (2009) also noted positive student feedback in support of using ARS and peer instruction techniques with conceptual questions. Both studies elicited student feedback on perceptions of learning while using the technology. Improved student attitudes toward ARS use have been identified with peer discussion, compared to passive questioning or independent work (Keller, Finkelstein, Perkins, Turpen, & Dubson, 2007).

Doucet, Vrins, and Harvey (2009) compared student motivation for learning and long-term (one-year) retention of course materials when ARS and case study discussions were used (n = 86), in comparison to group discussion alone (n = 83). They used a variety of data collection methods including surveys, student focus groups, and observations. Student motivation and engagement were found to be higher in the group using ARS, but long-term retention of course materials were found to be the same between both groups.

Benefits of ARS for Students

ARS technology is an emerging area of research for nursing and health science faculty. Most of the available peer reviewed literature included student perceptions of benefits and barriers to ARS use. Perception studies, an important foundational step in building ARS usage, warrant a thorough review.

The environment of a large lecture hall combined with a traditional lecture-based teaching format can be an impersonal and intimidating experience for students (DeBourgh, 2008). Trees and Jackson (2007) identified that students favoured ARS use to traditional lecturing, the latter being perceived as less engaging and less effective in enhancing learning. Skiba (2006) asserted that ARS increases student and faculty contact which may encourage an active, dynamic, and collaborative learning environment.

The literature is replete with research and anecdotal writings on the benefits of ARS use for students. Some commonly cited benefits for students from the faculty perspective include: critical thinking, engagement of all learners, lessening of fear and embarrassment related to answering questions incorrectly, less conformity in answering questions, and limiting domination of class discussion to a handful of vocal students (Caldwell, 2007; Collins, 2007; DeBourgh, 2008; Draper & Brown, 2004; Stowell, Oldham, & Bennett, 2010; Zurmehly & Leadingham, 2008). Hoekstra (2008) surveyed and collected interview data from over 2,000 students whose perceptions of ARS use included improved classroom social environment and increased ability to apply key concepts.

Overall, student satisfaction with ARS technology is very high. Commonly cited student perspectives are: increased interest in the topic, in self-confidence, and in feeling of safety; ability to focus on key lecture points; improved knowledge retention and motivation to learn; less fear of embarrassment; and feeling more alert and awake during class (Auras & Bix, 2006; Kennedy & Cutts, 2005; Mastoridis & Kladidis, 2010; Menon, et al., 2004; Zurmehly & Leadingham, 2008). Also cited from past studies and anecdotal writings are benefits of increased participation, perceived improvement on exams, quizzes and positive learning environment (Crossgrove & Curran, 2008; Trees & Jackson, 2007; Zurmehly & Leadingham).

Zurmehly and Leadingham (2008) invited students in a medical-surgical nursing course (n = 93) to participate in an evaluation of ARS use during class sessions. The students' reactions to ARS were positive, the main areas of feedback being increased learning and understanding of course content, enthusiasm for the topic, improved contact with faculty, and ability to compare their level of knowledge to others in the class. DeBourgh (2008) also found an overwhelmingly positive result when surveying nursing students (n = 65) about ARS, most of whom perceived that ARS encouraged immediate feedback, helped them focus on key points, apply concepts, and clarify misunderstood content. However, almost the same number of students preferred traditional lecture (39%) to ARS use (43%), but also reported was that 66% of the students felt ARS helped them perform better in the course.

Medina et al. (2008) compared student perceptions of ARS technology in two focus groups of students (n = 13) from a dual-campus program. Participants cited that ARS technology was most beneficial with non-graded class activities but their major areas of concern with the technology were summarized as distraction from excess buttons on the keypad, inability to select multiple

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answers, anxiety of technology failure during examinations using ARS, and issues violating the code of academic integrity. Overall, they enjoyed instantaneous feedback, ability to compare their answers to other students, and felt that ARS technology motivated them come to class prepared to learn.

Benefits of ARS for Faculty

Using ARS in the classroom allows faculty to focus on student learning needs while simultaneously empowering students to become invested in the learning process (Zurmehly & Leadingham, 2008). In past anecdotal literature, higher education faculty members reported improved student preparation, increased classroom participation, and better classroom attendance with ARS usage (Auras & Bix, 2006; Cain, Black, & Rohr, 2009; Caldwell, 2007; Gauci, Dantas, Williams, & Kemm, 2009; Kay & LeSage, 2009). One of the most commonly cited benefits for faculty is the ability to assess student understanding in real time, and control the pace of the lecture. This allows for immediate explanation and clarification of misunderstood concepts and materials (Cain, et al.; Collins, 2007; DeBourgh, 2008; Mastoridis & Kladidis, 2010). Direct feedback of student performance also enables faculty to adjust teaching style or lecture speed to accommodate learning needs that arise from questions asked in class.

Currently, there is a paucity of literature about faculty perceptions of how ARS use has improved or changed teaching practice. However, a major benefit of using ARS is 'opening up' the learning environment to two-way communication, a potential personal benefit for faculty as well as students. Further study of faculty perceptions of personal benefits of ARS use would be advantageous.

Barriers to ARS Use

The extant literature on active learning and ARS appears overwhelmingly in favor of using this technology to engage students in the learning process, but despite strong support, there are barriers. Table 1 summarizes major advantages and disadvantages of ARS use.

Table 1

Advantages and Disadvantages of ARS Use

Advantages of ARS Use	Disadvantages of ARS Use
• Facilitates peer instruction • Improves student engagement • Improves student motivation • Facilitates assessment of student preparation and understanding • Improves motivation for students to prepare for class • Facilitates classroom practice of NCLEX questions • Improves student perception of positive learning environment	• Equipment may cause distraction • Causes instructor anxiety related to technology failure • Requires instructor time to learn to use the technology • Cost to students or schools

Some authors have stated that the time involved to research, purchase, and set-up the technology is a major barrier to its usage (Collins, 2007; DeBourgh, 2008; Kay & LeSage, 2009; Mastoridis & Kladidis, 2010; Zurmehly & Leadingham, 2008). Cost is another factor; hence the decision to implement ARS technology might need to be addressed at a university-wide level (DeBourgh; Skiba, 2006). Furthermore, gaining support of the information technology department, college deans, and faculty colleagues could potentially be barriers to usage. The commitment to use ARS in the classroom will also require faculty to change their teaching style in order to encourage an active learning environment (Collins). Additional barriers are increased time to plan lectures and questions, technology problems during implementation, and lack of technical support (DeBourgh; Zurmehly & Leadingham).

From the student perspective, the least favorable aspect of ARS technology is out of pocket cost of the device (Cain, et al., 2009). Kay and LeSage (2009) identified other student barriers such as monitoring concerns, time involved with learning a new technology and method of instruction, and difficulty following class discussions when multiple ideas are presented.

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State of the Art

The status of ARS has predominately been through anecdotal writings or descriptive studies on student and faculty perceptions. As ARS has emerged, however, more studies have focused on the impact of student learning. Anecdotally, there is some evidence in the literature that students perceive better performance on exams and increased learning when ARS technology is used (Crossgrove & Curran, 2008; DeBourgh, 2008). A few studies have demonstrated the effect of ARS on student outcomes, specifically on test scores or overall success in the class by course letter grade.

One of the first studies was by Halloran (1995), who examined the effectiveness of ARS in a convenience sample of nursing students in a medical-surgical course, comparing a traditional lecture-based course (control group) and an experimental group using computer technology. Halloran reported initially higher test scores in the ARS participant group, but overall there were no statistically significant differences found in course grades between the two groups. Stein, Challman, and Brueckner (2006) found similar results when they studied the effectiveness of an ARS-driven game. Participants were invited from pre-exam review sessions for a group of freshman nursing majors enrolled in fall (n = 155) and spring (n = 128) nursing anatomy and physiology courses. No significant differences were reported in the test scores of the group receiving the ARS-driven game and the control group who received traditional lecture format.

Berry (2009) conducted a similar study of nursing students (n = 65) in a pediatric course. A previous year's class, control group's (n = 61) exam grades (including the final exam) were used, and weekly quizzes using ARS were implemented with the 65 nursing student group. The two groups were not matched demographically but both sections did receive the same three 50-question unit exams and final exam. Berry found a small but statistically significant increase in only the second unit exam scores and overall course grades. Alexander, Crescini, Juskewitch, Lachman, and Pawlina (2009) found a strong, positive correlation between student final exam scores and participation with in-class multiple choice ARS questions over a three-year period. Cain, Black, and Rohr (2009) also reported similar increases in mean course grades for a group of 109 pharmacy students after ARS technology was implemented. Non-experimental pre-test/post-test designs were used for these aforementioned studies, limiting the generalization of the findings. All of the researchers collected survey information on student perceptions, which showed that they perceived the technology positively, and that it enhanced their course performance.

Crossgrove and Curran (2008) also examined differences in student test performance among courses for biology majors and non-majors in which ARS was used in class. They reported that biology non-majors in ARS classrooms perceived better performance on exams, but there was no statistical difference in exam scores in either the major or non-major courses using ARS. Demonstrated however, was long-term retention (one year) of core concepts taught using ARS for both majors and non-majors. Gauci et al. (2009) noted that students using ARS exhibited improvement in mid-semester and final grades, compared to the previous year's data. Interestingly, they also found that lower achieving students had better outcomes throughout the semester than their middle or high achieving counterparts, although not assessed was long-term retention of the course material.

ARS use has also been compared to both study guides and group quizzes in one study by Carpenter and Boh (2008). Anatomy and physiology students (n = 63) were given a combination of active learning strategies for three different topical sections of the course, and success in learning was measured by weekly quizzes. Quiz scores were found to be higher when ARS was used compared to study guides alone, or when a combination of study guides and group quizzes were used. While students preferred ARS, they perceived the most benefit from study guides, but topics differed in each comparison group which could have confounded the results. Nonetheless, these findings seem to reinforce the benefits of using a variety of active learning strategies.

Course performance has also been examined by testing a standard ARS group (n = 64) against a personal digital assistants (PDA) group (n = 87) (Beuckman, Rebello, & Zollman, 2007). The PDA group advantages included the ability to respond to short answer questions, rank answers, and send questions and comments to the faculty in real time. Course grades were found to be higher (more letter grades of A or B) in the group using PDA versus the ARS group.

While anecdotal evidence suggests advantages to learning using ARS, studies conducted thus far show conflicting results. One possible explanation proposed by Halloran (1995) is student desensitization to the technology over time, accounting for initial increases in exam performance not correlating with course performance overall. However, there are many variables that can confound these types of studies, as well as the complexity of studying student performance in general. Mixed methodology studies that examine long-term retention of course materials may be more beneficial than examining test scores and course letter grades.

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Areas of Agreement and Disagreement

There is developing evidence in the literature to suggest that ARS usage improves engagement, encourages participation, increases attention, and creates a more dynamic classroom environment. Both students and faculty alike have noted these benefits, and students may perceive an improvement in course performance and material retention despite little statistical evidence of changes in exam or course grades. This area of emerging research is limited by a lack of experimental studies with random sampling. It is difficult to assess whether differences in grades or student learning are a product of ARS use, characteristics of the students or classes, improvement in teaching, or a combination of other confounding factors. The challenge for nursing faculty is how to best use this emerging ARS technology and to design questions that enhance active learning and critical thinking while continuing to study the benefits. As Lantz (2010) has noted, ARS technology should be used for more than entertainment in the classroom setting. It can be effective in increasing conceptual understanding of course materials. Hence, best practice guidelines for faculty using ARS are essential.

BEST PRACTICE RECOMMENDATIONS FOR FACULTY

Best practice guidelines for ARS are included herein from a review of the available literature. Practical application techniques are presented along with state of the art uses for ARS. Concluded are recommended areas for further research.

Literature-based Practical Application Techniques

Nursing faculty wishing to employ ARS technology in the classroom should first make certain support is available from the department or school and information technology services. Discussion at faculty meetings and having faculty development sessions should help to assess interest for the technology at a school-wide level. Discourse on the topic will also allow for decisions to be made about the school owning ARS devices versus having students purchase these individually. Before using ARS in the classroom, faculty should take tutorials and practice using the technology, as well as determine the objectives and frequency of use (Jones, Henderson, & Sealover, 2009). This process should begin with a reflective period of identifying what is to be achieved by implementing the technology in the classroom. Despite conflicting results about improvements in test or course grades using ARS technology, the benefits of engagement with the material, group discussion, and enhanced content mastery make this a worthwhile endeavor. The key factor is to have a clear objective that will be met with use of the technology. Questions that might determine the purpose of ARS usage may

include, what learning goals do I have; do I want to learn something from or about the students; what am I hoping the students will learn; what will the students learn from each other; do I want to engage students in small or large group discussions?

For novice ARS users it is important to practice setting up the technology and inputting the questions. Table 2 consists of information on how faculty could create interactive slides from previously developed questions in a step-wise format.

Table 2

Process of Creating Interactive Slides for ARS

Step	Process
Format Microsoft Document	Open and remove previous assigned numbers and bullets
	Format all stems of the question as heading 1
	Format all answer choices as heading 2
Import Document into ARS	Open ARS system
	Select tools
	Scroll as select parser
	Navigate to saved document
	Pop-up box will prompt to select and insert slide and/or to create a new slide
Creating Interactive Picture Slides	Create a basic slide in ARS
	Set correct answer and correct answer indicator
	Add pictures into slide directly from power point tool bar
	While holding control key, click on each image in the order you want to be numbered
	Click on the convert to a picture slide icon on ARS toolbar
	The slide will display pictures answers

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Creating Priority Ranking Slides	Insert slide on ARS tool bar Select priority ranking from menu Pop up box will prompt you to choose the number of answers your participants will be able to choose. Select OK when finished. Type in the question and answer choices. Note: ARS calculates priority ranking by assigning a point value to each participant's answer. The first answer is weighted more than the second, etc.
Running Team Competition	Assign teams through a participant list (i.e. clinical groups) or through a team assignment slide. Ask ARS question with correct answer. Set appropriate point value. Insert Team Leader Board from tool bar into presentation Run presentation

Item writing. General strategies for test item construction should be used as a guide for developing ARS questions. The two major categories of questions that can be used with ARS technology are content questions and process questions. Content questions include knowledge-based, clinical reasoning, one best answer, and alternative style questions. Process questions, on the other hand, are used to gather information from students to help them interact in class and to become engaged with the course content. Process questions include student perspectives, confidence level questions, monitoring questions, and faculty feedback questions.

The goal of nursing education in the United States is to prepare nursing students for professional practice and graduates for success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN). Knowledge-based questions are beneficial to help students master the material and build their confidence levels. As with other test item guidelines, they should be limited to approximately 15% of ARS questions. In contrast, clinical reasoning questions facilitate student discussion and learning, and therefore, comprise about 85% of ARS questions. Using content questions, especially clinical reasoning questions, may be helpful in preparing students to take NCLEX-style questions (Rayfield & Manning, 2006). The more challenging the question, the more engaged the learners are and a better discussion will ensue. Table 3 below depicts

an example of a one answer knowledge-based question versus a clinical reasoning question that could be used with ARS technology.

Table 3

One-Best Answer Example

Knowledge-Based Question	*Clinical Reasoning Question*
The normal body temperature is: 1. 98.8 2. 96.8 3. 98.6 4. 98.0	The client's temperature is 98.8. The nurse should: 1. Sponge the client with a cool liquid 2. Cover the client with a blanket 3. Report the temperature to the physician 4. Chart the temperature

Item writing, whether it is prepared for paper-pencil tests or ARS use, presents consistent challenges with crafting answer choices that students are likely to select. In trying to develop good answer choices or distracters for clinical reasoning questions, look for student responses to open-ended questions used in prior semesters. This can help identify common student misconceptions which will facilitate class discussion. Faculty often struggle with fitting clinical reasoning questions onto one slide. One slide could serve as the question, while the following slide displays the distracters. Using alternative style questions such as 'select all that apply' may also be beneficial for initiating an animated class discussion.

Process questions including student perspective questions do not assess student learning but student perspectives instead. Examples of process questions include: demographics (age, gender, culture), opinions (feelings about issues presented in class, i.e. abortion), or personal experiences (places they have visited). These questions can be useful first day icebreakers or effective questions to stimulate thought and discourse on nursing-related issues. Process questions allow students to answer sensitive questions with anonymity and discover similarities and differences in their perceptions or life experience as compared to their class peers. These types of questions at the beginning of class make the course material relevant to students in a way that generic course materials or research findings do not.

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Confidence, monitoring, and reminder questions are three examples of process questions that can be used with ARS technology. Confidence questions query students in how confident they were in responding to clinical reasoning questions. By using confidence questions nursing faculty can quickly ascertain comfort with the topic and can easily identify areas requiring clarification. Monitoring questions engage students by having them report their progress toward outcomes on projects or papers. This style of questioning gives faculty a sense of where the students are in completing class assignments and can be used in planning how to support students as they continue their work. These questions give feedback to students of where they are in their progress compared to their peers. Another type of monitoring question might be to query the class about how long it took them to complete a certain course assignment. This gives faculty information about how difficult the assignment is, and is helpful in planning for future courses. Monitoring questions can be asked during the semester for formative evaluation. This gives the faculty member time to make revisions in the methods or teaching strategies of the course. A final process question type is a reminder question. Aspects of the course syllabus including due dates or grading criteria are often forgotten. Reminder questions allow faculty members to reinforce key policies or pieces of information from the course syllabus.

Best practice with ARS technology is a reflective process for faculty. Experimentation with a variety of content and process questions is valuable. Question variety engages the learner and makes the course more interesting for students and faculty alike. ARS technology should be used throughout the class period and not just for attendance or a quiz. Using ARS questions in sets every 10 to 20 minutes can help focus students' attention on the material (DeBourgh, 2008), and the questions should highlight or emphasize the most important content (Robertson, 2000). Most authors recommend between two and five ARS questions for a 50 to 60 minute class period (Caldwell, 2007; Premkumar & Coupal 2008; Robertson). When writing ARS questions, a common best practice tip from the literature is to give no more than four responses for a multiple choice-type question (Premkumar & Coupal; Robertson). It is also necessary to provide clear instructions to students on how to use the technology and procedures for voting (Robertson).

When using ARS technology for questioning, the peer instruction technique can be used. Initially, students should respond individually. This allows them opportunity to think for themselves prior to discussion. It is also important for faculty to strategically show the answer. Often students are less likely to discuss the question or responses if they know for certain they are correct. As well, students should learn why a distracter is wrong. Asking students their

rationales provides insights about student thinking and assists faculty to identify and clarify misconceptions. Once the class period is over, faculty should reflect on how a particular ARS question worked for the class, and keep detailed notes and suggestions for changes the next time the question is used. This reflective process is essential for making improvements to ARS questions over time.

New uses for ARS technology. Content questions used with or without the peer instruction process are useful in helping to teach metacognition, enhance critical thinking skills, and promote mastery of key concepts. ARS can be used for more than NCLEX-style questions, class surveys, quizzes, and evaluation. Gaming is a popular teaching technique in nursing education and can be made into a peer instruction game with ARS technology. Students can answer gaming questions individually or in groups, enhancing peer learning while engaging all learners.

As the technology progresses, ARS technology can be used in distance learning which would allow faculty to enhance peer learning. Newer ARS devices with enhanced capability allow students to write questions to the professor during class, stimulating classroom dialogue. Another possibility is to use it for spontaneous questions that can be added to the presentation during class (i.e., when students need bathroom breaks). Beyond the classroom, ARS devices can be used in both student and faculty meetings. ARS allows individuals the freedom to express an honest but anonymous opinion and to quickly gauge responses during voting procedures. As the technology continues to emerge, there should be new opportunities to use these devices.

Areas of future research. In order to add to ARS research, it is important that faculty evaluate ARS techniques that have been or are being employed. Well designed experimental studies comparing ARS to other teaching modalities could provide additional data supporting further use. Mixed methodology studies that combine experimental or quasi-experimental designs with qualitative interviews or observations would also allow students and faculty to share their experiences with the technology. As ARS continues to develop, more faculty members might be encouraged to use the technique.

CONCLUSION

ARS technology is a useful and effective active learning strategy for nurse educators to employ in the classroom. The technology allows dynamic, engaging two-way communication between faculty and students, with noted benefits to student learning from both the perspective of the student and the faculty member.

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Success in initiating ARS technology in the classroom involves carefully crafting learning goals and preparing relevant questions that will help prepare future nursing graduates for success in licensing exams as well as for professional practice. When nursing faculty use active learning strategies in the classroom, both students and faculty benefit. ARS technology can enliven teaching practice and allow students to become invested in the learning process.

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