

**Working Paper
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**An exploratory study on the use of
Audience Response Technology (ART) via SMS
in large lecture classes**

Mak Wai Keong
Centre for Applied Research, SIM University
535A Clementi Road, Singapore 599490
Email: wkmak@unisim.edu.sg
Phone: (65)-6248 9255

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Abstract

Audience response is an essential feedback to instructors in a large lecture setting to ascertain that the audience follows the presentations, understands the material of discussion and even getting consensus of the cohort on certain issues or questions. Traditionally, some lecture theatres are equipped with proprietary audience response technology (ART) and each participant is given a wired/wireless response device to key in their choices. The responses are fed into the ART which will generate a report in the form of graphs or charts.

Short Messaging Service (SMS) is a pervasive technology that has wriggled into our lives. With a mobile phone in hand, coupled with a subscribed line, the user is able to send messages to other mobile phone users. Such messages can also be received by the SMS gateway which can be fed to algorithms to generate the required charts. There is no necessity for the purchase of any propriety system.

This paper is an exploratory study on the use of ART via SMS for audience in large lecture settings. A modified 41-item version of the Audience Response Technology Questionnaire (ART-Q) (Erina. L & et al., 2008) will be used to elucidate audience feedback in a multi-dimensional approach. Lecturers' feedback through interviews will be gathered qualitatively to elicit their perspectives on its use and the impact on their presentation. This study provides insights into instructors' techniques for using ART from an educational perspective. The paper will also explore other opportunities for the application of ART via SMS in the world of conferences, seminars, conventions and in marketing.

Keywords: Audience Response Technology, short messaging system, large lecture classes

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Introduction

Audience response is an essential feedback to instructors in a large lecture setting to ascertain that the audience follows the presentations, understands the material of discussion and even getting consensus of the cohort on certain issues or questions. Traditionally, some lecture theatres are equipped with proprietary audience response technology (ART) and each participant is given a wired/wireless response device to key in their choices. The responses are fed into the ART which will generate a report in the form of graphs or charts.

Banks (2001, 2003, 2006) had used ART in a variety of educational and commercial settings to small groups of students. Erina & et. Al. (2008) used ART on a large audience (n = 854) for three large lecture university courses. The use of ART has positive impact in the classroom. It enables learning in a student-centred, assessment-centered, knowledge-centered and community-centered model of teaching and learning (Roschelle, Abrahamson and Penuel, 2004)

ART has been used in many educational and commercial settings:

Subject Area of Use	Author
Economics teaching	Elliott C., 2003
Decision Support Systems	Banks D.A. and Monday A., 2006
Earth Science course	Greer L. and Heaney P. J.,
Economic and Policy workshops	Gustafson, C. and Crane L, 2005
Economics in graduate business school	Williams J. B., 2003
Engineering course	Silliman S. E. and McWilliams L., 2004
feedback for an interactive workshop	Salmon T.P. and Stahl J.P., 2005
mathematical science – statistics	Wit, E., 2003
Medical education	Latessa Robyn and Mouw D., 2005
Physics	Poulis, J., Massen C., Robens E. and Gilbert M., 1997

Table 1: Use of ART for educational and commercial settings

ART has also been referred as Student Response Technology (SRT) (Greer L. and Heaney P. J.,), others coined it as Audience Response Technology (ART) (Erina L. & et. al., 2008). There are many terms that refer the similar device or technology for the purpose of taking response from the audience (respondents):

Term used	Abbreviation	Author
Audience Response Technology	ART	Erina L. & et. al., 2008
Audience Response System	ARS	Erina L. & et. al., 2008, Latessa Robyn and Mouw D., 2005, Gustafson, C. and Crane L, 2005; Silliman S. E. and McWilliams L., 2004; Williams J. B., 2003; Salmon T.P. and Stahl J.P., 2005
Personal Response System	PRS	Wit, E., 2003; Elliott C., 2003; Gustafson, C. and Crane L, 2005; Williams J. B., 2003
Audience Paced Feedback	APF	Poulis, J., Massen C., Robens E. and Gilbert

		M., 1997
Student Response Technology	SRT	Greer L. and Heaney P. J.,
Classroom Performance System	CPS	Erina L. & et. al., 2008, Greer L. and Heaney P. J.,
Personal Response Technology	PRT	Gustafson, C. and Crane L, 2005
Audience Response Device	ARD	Salmon T.P. and Stahl J.P., 2005

In this paper, ART shall refer to the device/technology to be the SMS Response System (SMSRS). As its name implies, SMS is the over-arching technology that provides the transfer of formatted responses. A SMS gateway is setup to receive the incoming messages from respondents. This gateway will route the information to a database (MySQL) where the data is stored into appropriate fields using programming algorithms in ColdFusion.

How does it works

This section will explain how SMSRS works.

In a large lecture setting, the lecturer can ask a question and may be inundated by the verbal responses from the students (or the lack of it because of shyness and anxiety in open dialog engagement (Groves, Gear, James. Connolly and Read, 2006).)

For example, the following question was asked by the lecturer in a statistical course

“If the alternative hypothesis is $H_1: p > 5$, is it a one-tail or two-tail test?”

The answer options are:

- a) One-tail test
- b) Two-tail test

Key in your answer in your mobile phone: *STAT101 1 a* (for answer option a)

The format is <Domain> <Question Number> <Answer items>

Domain: STAT101

Question Number: 1

Answer items: a (can have multiple answers- up to a total of 10 per question: it will be referred to as 1a, 1b,...1j)

The students will send the above response to a specified mobile number.

After some time period for all students to submit their responses, the tutor will invoke the system which is on the Internet. After logging into the system, the tutor is able to select the question number to view the responses.

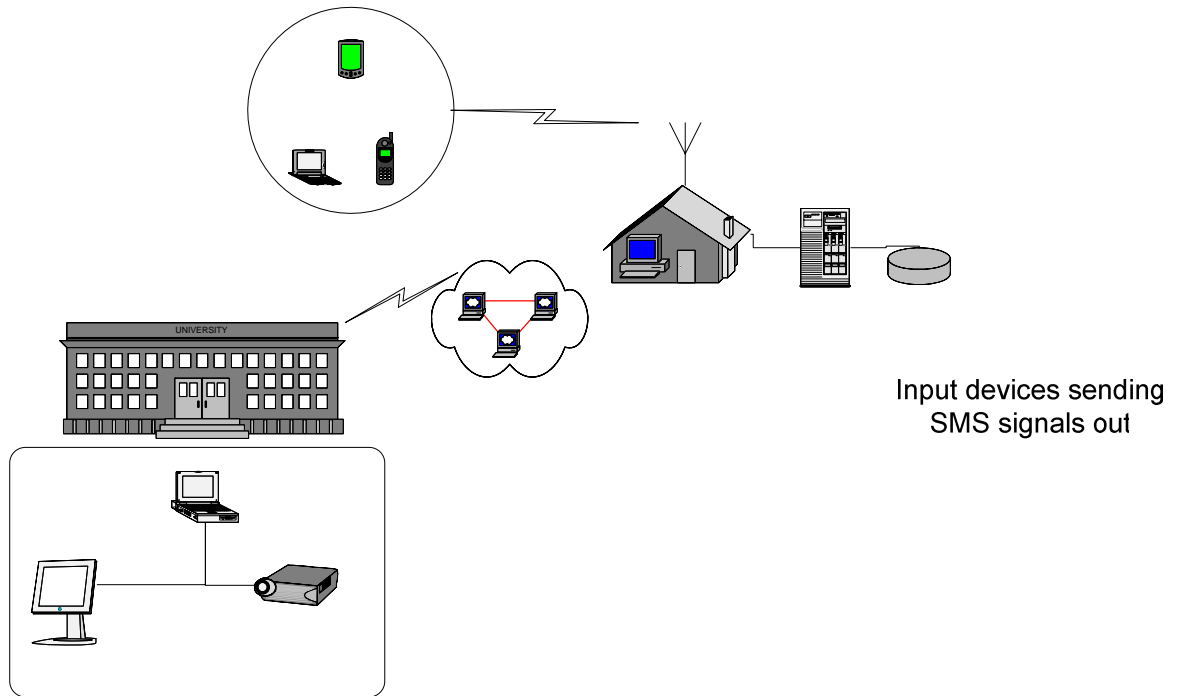


Figure 1: Schematic diagram to depict the network relationship and setup

The output can be displayed in various formats: Bar (default), Pie, Horizontal Bar, Cone, Curve, etc. In addition, the display can exist as an image file or as a Flash file (animated – you will see the bar rising up).

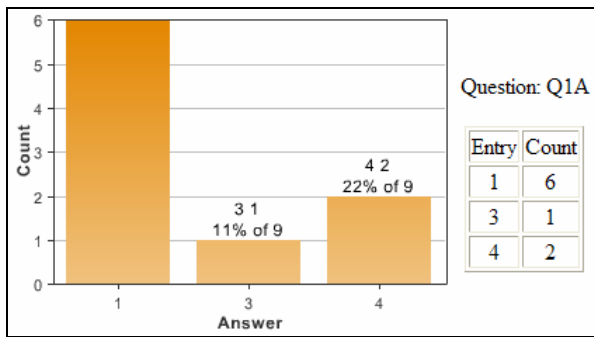


Figure 2: Bar graph of a sample output

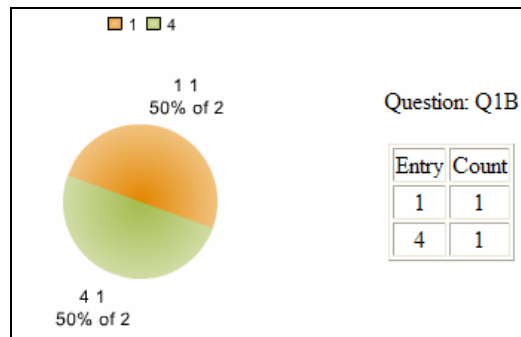


Figure 3: Pie graph of a sample output

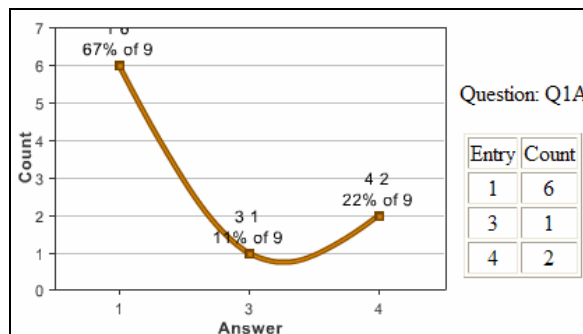


Figure 4: Curve of a sample output

Projector display

Figures 2-4 are some examples of images that can be displayed by the system. If the data is numerical, the system will be able to provide some simple statistical data such as mean, median, variance, standard deviation, etc.

It is in the pipeline that the SMSRS will eventually be able to perform more advanced statistical analyses such as comparison of means, hypothesis testing and regression.

With the displayed results, the lecturer is able to know immediately if the majority of the students are able to perform the given task. In subsequent sections, the focus will be on the pedagogical approaches that users can undertake when using SMSRS in their teaching.

The study

This study is multi-fold. It comprises survey questionnaire for students to express their perception of using SMSRS. The lecturers will also be interviewed for their teaching practices associated with the use of SMSRS.

The quantitative evaluation instrument is adapted from Erina L. & et. al. (2008) that provided a multi-dimensional evaluation of ART. Erina and et. al. have coined the questionnaire as Audience Response Technology Questionnaire (ART-Q). This survey will be given to students after 4 weeks of usage of SMSRS (see Appendix A).

The study plans to involve at least 4 lecture groups for various topics: Statistics, **Topic 2, Topic 3 and Topic 4.**

The study will also monitor the attendance of the students at lectures - an issue that has been raised by the academic staff. Studies have shown that use of ART is associated with a rise in attendance (quote).

In addition, one pertinent question that is added to the ART-Q is the issue of cost to the student – “I am fine to pay for the SMS charges incurred in sending responses to SMSRS”.

A review will be performed with the lecturers who use the system during their lectures. At some point during their lectures, video cameras will be used to film the session on how SMSRS is embedded in the teaching process.

Good Practices

Assessment

SMSRS (ART in general) can be used for formative and summative assessments. Multiple Choice Questions (MCQs) can be setup to test content knowledge (Draper S. W., 2002). Draper suggested that such a system can be used to probe “understanding than information retention” if the questions are properly crafted.

However, using SMSRS for simple question and feedback is primitive and basic, undermining its greater affordances. There are many strategies associated with the use of ART. This section will explore some opportunities provided by the use of ART/SMSRS to facilitate collaboration for engaged learning.

Opportunities for discussion

Error analysis has been a field of study that educationalists work on to study the types of errors that students frequently succumbed to. In a typical response from students, some of them would have gotten the incorrect answer. It is, within time constraint, to explore with the cohort on why students select the wrong answer. In such an error analysis, students may voice out their solutions, in which the cohort can learn from the potential mistake-causing areas, and hence be wary and to avoid.

Alternatively, students can find out why the wrong answer was chosen by a certain proportion of the students, to decipher which steps in the analysis or calculation that have gone awry. This provides opportunities for students to reflect, to analyze and be engaged in the learning process.

Opportunities for collaboration

There may be occasions where the responses are distributed among the answer options. This spells a situation where students have multiple and differing conjectures. At this juncture, the lecturer can be “playful”. The lecturer can, for example, try to mimic the popular reality TV show: “Who Wants to be a Millionaire” (Seenan, 2000). The 50-50 gimmick can be used where the lecturer will eliminate 2 of the answer options, and get the students to re-vote on the remaining answer options. Alternatively, the lecturer can ask the students to discuss with the next person on their choices and then do a re-vote.

This creates the environment for collaboration and cooperative learning, where students can engage among themselves in a situated manner (the issue in contention) to share and critique the train of thoughts in deriving their answers with other students.

Conclusion

This working paper lays the framework for the pilot use of an education technological innovation: SMSRS. Its prowess lies not in the technology but in the capitalization of its ability to be used as a tool to support education processes – teaching and lecturing. Its use can be centered around a pedagogically sound framework, relying very much on how the users of this innovation are able to integrate the system into its delivery framework.

The feedback from students and from the lecturers will be a good source of information on the use of such a system for education, enriching the body of literature and scholarship on the use of ART.

From a business perspective, SMSRS has great potential to be used in seminars and conferences where responses of the participants can be captured, including conference feedback and

comments to the presenters. In fact, SMSRS has a text feedback system in which the audience can send text messages to the presenter and have the comments/queries flashed onto the screen (via a projection system).

1. **This is message 3** Paschal Abel Tay
(10 Aug 2007 9:25:31 PM)
2. **This is message 2** Paschal Abel Tay
(10 Aug 2007 9:25:31 PM)
3. **Replace Econf with single or none character which user easy to type.** Paschal Abel
Tay
(10 Aug 2007 9:25:31 PM)

Figure 5: Screen capture of the scrolling text for textual response via SMSRS

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Appendix A

Use of SMS Response System During Lectures

This survey is conducted to understand your use of the
SMS Response System (SMSRS) for your learning.

Your input will be valuable to understand and improve on the use of such technology for teaching and
learning.

Please fill up your response to the 41 questions below. Thank you very much.

Name: _____ Lesson: _____

Gender: Male / Female

Number of Mobile Phone: 1 / 2 / 3 / >3

S/No.	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
1	Because of SMSRS, I have a better idea of what to expect on exams, quizzes, or assignments.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I believe that I know more about what will be emphasized on exams, quizzes, or assignments because of SMSRS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Using SMSRS gives me a preview of what I will need to know for exams, quizzes, or assignments.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Because of SMSRS it is easier for me to tell whether I am mastering course material.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Because of SMSRS I am more certain about how I am performing in the class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Using SMSRS helps me more easily determine how well I am doing in the class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	My knowledge of course material is improved by using SMSRS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	I understand more in this class because we use SMSRS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	SMSRS helps me learn course material better.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	SMSRS technology is interfering with my getting a good grade. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Because we are using SMSRS, I expect to get a lower grade than I would otherwise. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Using SMSRS is negatively impacting my grade. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Because SMSRS is used, I attend class more regularly than I would otherwise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Using SMSRS increases my likelihood of attending class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	SMSRS motivates me to attend class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

S/No.	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16	Using the SMSRS is fun.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	It is exciting to answer questions using SMSRS technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	I enjoy using the SMSRS technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	I do not like using SMSRS. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	I have had a good experience with SMSRS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	I would like to use SMSRS in future classes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	I think SMSRS should be used in this class in future semesters.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Using SMSRS makes me more likely to review my notes prior to class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Using SMSRS encourages me to do readings prior to class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	Because we use SMSRS I prepare for class more than I would otherwise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	SMSRS boosts my enthusiasm for studying the material we learn in this course.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	Using SMSRS makes me more motivated to learn in this course.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	If we didn't use SMSRS, I would be less interested in the topics we cover in this course.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Using the SMSRS technology is easy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	I have no problems using the SMSRS technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	Using the SMSRS technology is pretty hard. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	I feel more engaged during class because we use SMSRS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	Because we use SMSRS, I have a greater sense of participation in the class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	Using SMSRS heightens my interest in whatever else we do during class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	I wish we spent less time using SMSRS. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	Time spent on SMSRS is time well spent. .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	I have thought about not answering or actually did not answer a SMSRS question because I was afraid someone near me would see how I answered. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	As I use the SMSRS keypad, I am concerned about other students seeing how I answer. [Reverse]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	Using SMSRS makes me more attentive during lecture or other class activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	Using SMSRS helps me focus on the subject matter during class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41	I am fine to pay for the SMS charges incurred in sending responses to SMSRS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Any other concerns about the use of SMS Response System:

