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Student perception on a student response system formed by combining mobile phone and a polling website

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ABSTRACT

Every teacher understands the importance of getting timely student feedback for effective and efficient teaching and learning. However, students are not always keen to answer questions in the classroom in front of their peers. There is a need for an efficient method to engage all the students in a classroom and quickly evaluate the progress of their learning.

Student response systems (SRS) are effective increasing student engagement, even in a large lecture hall. In a traditional SRS, the students use a small portal device, called a clicker, to choose their answers. Then proprietary hardware and software will collect and display the results to the class. With the widespread use of mobile phones, it is possible to replace the clickers with mobile phones, and the proprietary software with commercially available polling website.

This study used a polling website and combined it with the mobile phones of students to form an SRS. The SRS was for 6 weeks and 1,155 answers were received. A survey afterwards showed that the students had very positive attitude towards the SRS. The majority of the students indicated that SRS made the lessons more interesting and helped them to maintain their attention. They also indicate that they were willing to use SRS in future.

Keywords*: Student Response System; Mobile Learning; Polling; Clickers; Smart Phone; Learning Management System; Class Response System; Audience Response System*

INTRODUCTION

To achieve effective and efficient learning, student engagement is essential, but not easy to achieve (Micheletto, 2011; Wang, Shen, Novak, & Pan, 2009). In a classroom where the majority of the students are Chinese, the lack of student engagement is often an obstacle to achieving the learning outcomes (Wang et al., 2009). As digital technology continues to improve and become more economically viable to schools, many researches have been done to exploit technology to increase the student engagement (Hwang, Wu, Tseng, & Huang, 2011; Jungsun & Kizildag, 2011; Liu & Chen, 2015). Recently, many researches have focused on the use of SRS (Student Response Systems) in which the teacher can gather and summarise answers from students inside the classroom immediately (Carnaghan, Edmonds, Lechner, & Olds, 2011; Seamus McLoone, Villing, & O'Keeffe, 2015; Monk, Campbell, & Smala, 2013; Valle & Douglass, 2014). In a traditional SRS, the students use a small portal device, called a clicker, to choose their answers to questions. Then some proprietary software with summarise the responses from the students and display them on screen (Williams & Boyle, 2008).

Many studies revealed that SRS are effective increasing student engaging and active learning (Cain, Black, & Rohr, 2009; Lindquist et al., 2007; Park, Nam, & Cha, 2012; Şad & Göktaş, 2014). They are especially useful in creating a more engaging environment in a large lecture hall. The main benefit of using an SRS is that students are not afraid to answer questions because

students can only see the statistics of the different answers, but not the individuals who gave the answers. However, using clickers means the school or the students have to purchase the hardware and software (Monk et al., 2013). Also, the clickers are usually small numeric keypads that have limited text entry capabilities. With the widespread use of smart mobile phones, it is possible to replace the clickers with mobile phones, and the proprietary software with commercially available polling website. The resulting system can be called a "mobile phone based SRS".

If the mobile phone based SRS is technically feasible in a school and if students have positive perceptions of using such a system, then teachers can use it in class to increase student engagement and to identify individual students who are underperforming. Therefore, the purpose of this study is to perform a pilot study at a particular school, and then survey student perceptions to provide a reference to teachers at the same school for their decisions to use the system or not. The rest of this article is structured as follows. It starts with by reviewing the advantages mobile phones over the traditional methods of getting student feedback in the classroom. Then it reports the study that using an SRS that was created by combining a polling website with mobile phones of the students. Finally, it shows the results of a survey about the student's perception of the use of SRS. Lastly, some suggestions for future research in this area of mobile learning are suggested.

MOBILE PHONES BASED SRS VERSUS TRADITIONAL QUESTIONING METHODS

In the tradition classroom where no technology is used, the teacher cannot get real-time feedback from all the students in the classroom. Typically, the teacher will ask some questions and request students to answer them verbally or raise their hands to choose their answers. Alternatively, the teacher may ask students to write down their answers on pieces of paper. These traditional methods have been used over a long period of time and can be used across many disciplines. Since no technology is involved, there is no computer knowledge or equipment requirement. However, this traditional method has some shortcomings that greatly reduce its effectiveness, especially in large lecture theatres.

When the teacher wants to get qualitative answers from students, they would invite students to answer open-ended questions verbally. Many students are too shy to give verbal answers in front of their classmates (Wang et al., 2009). Therefore, some students who are extroverts will be responding to questions frequently, and the teacher cannot get answers from the shy students. It is possible that the shy students may have some creative and original answers that the whole class can benefit from. Moreover, it is not uncommon that when students try to answer questions verbally, their voices are so low that the teacher and the rest of the class cannot hear them clearly. This problem becomes more serious in Hong Kong where classes are often conducted in English, but the student's mother tongue is Chinese. If students can use mobile phones to provide answers without revealing their identities to the whole class, even shy students are not intimated to answer questions and show their answers in front of the class.

When the teacher wants to get quantitative answers from students, they would invite students to raise their hands to indicate their choice of answers to close-ended questions. If the teachers ask the students to raise their hands, many of them are afraid to be the first ones. Conversely, when most of the students raised their hands, the remaining few students are often forced to raise their hands too (Withey, 2010). Raising hands creates the problem for the teacher because it is hard to count and even harder to keep track of who raise their hands to what question. Therefore, the raise-of-hand method can only provide a general impression of student's understanding of the contents, but cannot be very effective in identifying and tracking the progress of students who have misconceptions. If the teacher collects answers in written form in class, then the teacher has

the extra effort of handling paper and try to interpret styles of writing that are sometimes difficult to read (Bae & Kim, 2014; Cheung, 2008).

The limitations of the traditional methods stated above mean the teachers who teach the same subject cannot easily and accurately compare the response and progress of the students. With a mobile phone based SRS, the teacher can collect and show answers instantaneous on screen. Students will not feel anxious to answer questions because students can only see the statistics of the answers, but not the names of students who gave the answers. However, the teacher can track the answers to individual students using reports provided by the website. The answers are stored on the server and can be analysed by the teacher later. There is no extra effort to count hands and handle paper. The teacher can focus on the teaching. The statistics help the teacher to pin point the students who have misconceptions and, therefore, need more help. The statistics from different classes on the same subject can be collated and compared easily. However, the use of a mobile phone based SRS does require certain technical skills on the teacher, the cost of subscription to a polling website and having a good Wi-Fi coverage in the classrooms involved. Furthermore, there is a possibility that students may become less responsive when traditional questioning methods are used.

THE STUDY

The study was carried out at the School of Professional Education & Executive Development of the Hong Kong Polytechnic University. The subjects of the study were full-time students who were at their first-year of a two-year top-up degree programme in information technology. After completing the top-up degree programme, the students would get their bachelor degree in Information Systems and Web Technologies.

The author used PollEverywhere, a commercially available polling website to teach a class of undergraduates who were taking the Management Information Systems course in Hong Kong. The author also compared PollEverywhere with similar websites such as Socrative. The website was chosen based on cost considerations and the fact that the author learned to use it in a seminar about teaching and learning. PollEverywhere can accept student response in a number of channels including SMS text, Twitter and Web. This study only accepted student responses through the web because of the following reasons. Firstly, SMS text may have cost implications for the students, who are studying full-time. Secondly, Twitter is not popular among the students in this school.

There are no costs to the students who are subjects of this study. The campus at which the author is teaching provides free WIFI access to all students via both the Eduroam and CPCE-Student. This means students do not need to subscribe mobile data plans for answering polls in this course. The software offered a free trial version which can only accept 25 responses per poll for business users. For educators, the software offered a free version which can accept 40 responses per poll. In both trial versions, grading of responses is not allowed.

The cost of the software is minimal and flexible. The author subscribed the USD19 per month plan which can accept up to 50 responses and allowed grading of responses. It is flexible because the plan can be terminated when polling is no longer required. In terms of question design, the author's subscribed version and higher version is the same. The more expensive versions have additional features such as moderation of answers, more responses per question and team competition. In some lessons, the author found it necessary to create questions immediately during the lesson. It took the author less than one minute to create a question and then poll the students for answers.

Student accounts are created without too much effort. The software can import student accounts directly from Management Systems (LMS) such as Blackboard and Canvas. Since the LMS is not supported by the software, the author created forty-four students accounts exporting student names from the School's LMS into a comma-separate value (CSV) file. Then they are formatted according to the requirements of the polling website. Finally, they are imported into the polling website to create usernames and passwords.

The SRS was used in 12 lessons over a period of 6 weeks. Thirty-five questions were asked and 1,155 answers were received. There are three types of questions, namely, true/false, multiple choice and open-ended. On average, three questions were asked through polling per lesson. The maximum number of questions used in one class was six. The student responses were exported from the PollEverywhere website and then imported into Microsoft Excel for analysis. The averages and standard deviations were calculated.

At the end of the study, a survey was conducted using an online questionnaire. The survey was performed in a computer lab in which the students filled out the questionnaire anonymously on a website which is different from the polling website. There were forty-four students in the class and thirty-nine students completed the questionnaire. The survey response rate was 89%. The results of the survey are presented and discussed in the following section.

FINDINGS

Both the hardware and the polling website worked smoothly during the study. The question creation process requires about one full day to learn. It was found that the majority (85%) students used mobile phones as the device for answer questions in the polls. Only a few students used the tablet (5%) and notebook computer (10%) to answer questions in the polls (Table 1). The phone reception was excellent in the classroom and no students experience problems in connectivity. Three students created their own guest accounts when they didn't have to. They answered questions using the wrong account until 7 out of the 33 polls are done.

Table 1 *Devices used by students for answering questions in the polls*

Device Type	Number of Students	Percentage (n=39)
Mobile phone	33	85%
Tablet	2	5%
Notebook Computer	4	10%

The response rate was satisfactory (Table 2). Students are more responsive to true/false questions, which have the highest response rate of 68%. Students are also willing to answer multiple choice questions, whose response rate is 56%. However, less than half of the students responded to open-ended questions. Note that the response rate is the percentage of student responses divided by students on the register, not students in the classroom. Since some students in the register may not attend all lessons, the response rate may be underestimated.

Table 2 *Response rates to different types of poll questions*

Question Type	Response Rate*	Number of Polls
Multiple Choice	56%	16
Open-Ended	47%	5
True/False	68%	2

The open-ended questions were useful because it is easy to spot the problems the students faced. There are two problems that occurred frequently. Firstly, many students did not follow the instructions and they used more words than the question allowed. Secondly, there are grammatical and/or spelling mistakes in their answers. For example, a student wrote down "willing to be promotion". No offensive or obscene answers were received for open-ended questions. This is probably because it was stated clearly at the beginning that the teacher could track the users to the students who made them.

The students were excited when the polling website showed statistics about the answers immediately and presented them in various formats. For the software being used by the author, four formats were possible. For true/false and multiple choice questions, the statistics of the answers can only be shown as bar charts (Figure 1). For open-ended questions, the answer can be presented on a word cloud or cluster (Figures 2 to 3). The students' answers to the questions about their perceptions of SRS are summarised in Table 3.

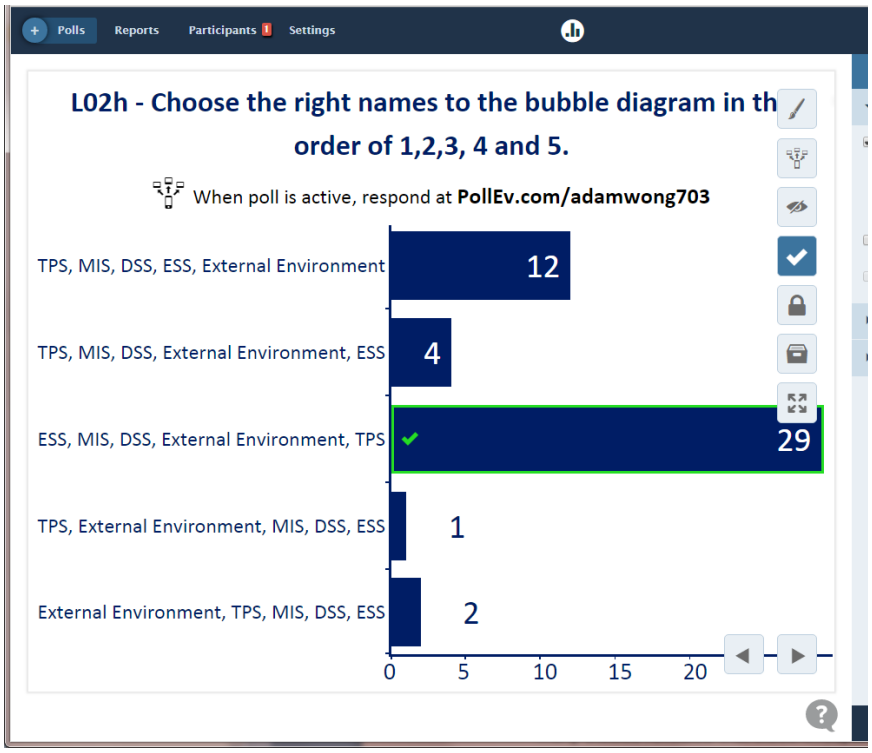

Figure 1: *Statistics of student responses to a multiple-choice question shown as bar chart*

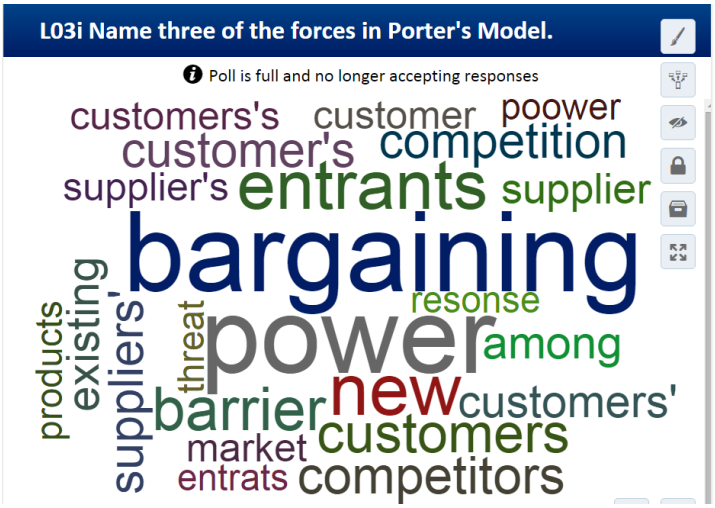

***Figure 2**: Student responses to an open-ended question shown as a word cloud*

***Figure 3:** Student responses to the same open-ended question as in Figure 2, but shown as clusters.*

***Table 3**: Student Perception on the SRS*

("1" to "5" represents Strongly Disagree, Disagree, Neutral, Disagree, and Strongly Disagree respectively)

	Statement	Average Score	Standard Deviation	%age of "Strongly Agree" or "Agree"
Q1	My mobile device(s) work(s) well with the polling website.	4.28	0.7493	95%
Q2	I can access the polling website easily.	4.13	0.8221	90%
Q3	Learning with SRS is relevant to the subject of Information Systems.	4.13	0.8221	85%
Q4	Answering questions using SRS helps me to maintain my attention.	4.10	0.9280	74%
Q5	Answering questions using SRS makes the lessons more interesting.	4.10	0.8999	77%
Q6	I have the necessary skills for answering questions using SRS.	4.18	0.7467	92%
Q7	It is easy to answer questions using SRS.	4.10	0.8410	82%
Q8	I am willing to answer questions using SRS in future.	3.95	0.9858	85%
Q9	If another lecturer uses SRS, I will answer all questions.	3.95	0.9322	72%
Q10	I like answering questions using SRS.	3.87	0.9917	67%

DISCUSSION

The following paragraphs discuss the student answers to the questions Q1 to Q10 listed in the table above. These questions can be divided into five groups. Each group will be discussed in a separate paragraph below.

Firstly, the students were happy with the hardware and the website that form the SRS. The mobile device ownership was 100% and all students were able to participate in the SRS using their mobile devices. This is consistent with similar research in other universities. For Q1 and Q2, almost all students said their devices worked well with the SRS, and that they could access the polling website easily. The scores were 4.28 and 4.13 respectively.

Secondly, the student had positive perception in the usefulness of SRS in helping them to learn the subject. For Q3, Q4 and Q5, the majority of the students also agreed that SRS is relevant to the subject, and that the SRS helped them to maintain their attention and made the lessons more interesting. The scores were 4.13, 4.10 and 4.10 respectively. It was probably because the answers from the students were shown in attractive ways such as bar charts, word clouds and clusters. It was also because some students gave unusual answers to some questions.

Thirdly, the students indicated that they didn't need much time and effort to learn to use the SRS. For Q6 and Q7, the majority of the students said they had the necessary skills to use SRS and it was easy to answer questions using SRS. The scores were 4.18 and 4.10 respectively. It was because the students only need to enter the URL of the polling website into their mobile device

and log in once in the first lesson. In subsequent lessons, the students didn't have to log in again. Also, because the teacher could control which exact question the students saw so that they didn't have to navigate around to find the right question to answer.

Fourthly, although the students were willing to use SRS in future, the average scores were lower than the three groups of questions above. For Q8 and Q9, the majority of the students mentioned that they were willing to use SRS in future and if another lecturer uses SRS, they would answer all questions. The scores were 3.95 and 3.95 for both questions, whereas the scores for questions Q1 to Q7 were all above 4. There are two possible reasons. The first possible reason is that the students in this study had no previous experience with SRS. Therefore, they would need more time to be comfortable and natural at it. The second possible reason is that the author was also new to such a system, and the use of the system might not have been well-integrated into the teaching of the subject.

Finally, the students indicated that they like answering questions using SRS. For Q10, the average score is 3.87, the lowest among the five groups of questions. The raw data showed that 26% of the students chose "Neutral" as the answer, while 5% chose "Disagree" and 3% chose "Strongly Disagree" to this statement. Therefore, more research is needed to find out why only sixty-seven per cent of the students liked answering questions using SRS. One possibility was that the polling website that was used in the study does not allow students to change their answers after submission. In more than one incident, students indicated that they submitted an answer that they didn't intend to. Another possibility was that the students didn't like typing in long sentences as answers.

Because this is an exploratory study, it is limited by the experience of the author with SRS. Also, there are other SRS that are available to students studying at certain universities at Hong Kong, but not available to the student in the author's university. One example is uReply, which was developed by the Chinese University of Hong Kong.

CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

In summary, this exploratory study shows that it is feasible to combine student mobile phones and polling website to create an effective SRS. The technical side of the SRS went well during the study. Students also agreed that it made them more attentive and the lessons more interesting. Students had generally very positive perception about the SRS, although more research is needed to understand why their intention to use SRS in future is not as positive as other perceptions of SRS. Séamus McLoone and Brennan (2013) did a study in mobile phone based SRS, but they used purpose-built software instead of commercially available polling websites. However, the results from this study are largely in line with theirs. One special finding is that the average scores on student's intention to use SRS in future and their general acceptance on SRS are lower than the other constructs. Therefore, there is a need to research on the factors that affect the student's intention to use SRS in future. For example, if the same cohort of students were to use SRS in the next semester, their perceptions may change. Also, if the teacher becomes more experienced with the use of SRS, the students may perceive its use more positively.

With the feasibility confirmed, it is suggested that the research on SRS be conducted for large lecture classes. It is also suggested that research be conducted on students whose major is not information technology related.

The SRS is an effective and efficient way to get real-time feedback from all students. However, the students would not benefit from it unless teachers are willing to adopt SRS as part of their

teaching. Therefore, it is suggested that the Technology Acceptance Model (Venkatesh & Davis, 2000) be adapted to find out the factors that affect the teacher's intention to use SRS. Furthermore, it has been shown that Internet technology such as online surveys can be an effective tool to perform peer evaluation (Wong & Ng, 2005). Therefore, one possible use of the SRS is to allow students to perform peer evaluations on each other's work.

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