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A cross-cohort exploratory study of a student perceptions on mobile phone-based student response system using a polling website

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ABSTRACT

Student engagement in the classroom is important for the achievement of learning outcomes. As digital technologies continue to improve and become more economically viable to students and schools, many schools have adopted the Student Response System (SRS) with the purpose of increasing student engagement. In an SRS, students answer the teacher's questions using handheld devices, called "clickers", or more recently, their own mobile phones via the Internet. The SRS gives the teacher an immediate assessment of the understanding of the students collectively and individually. However, there is very little research on mobile phone-based SRS using the Internet. Furthermore, the research on student perceptions using a cross-cohort approach was non-existent.

Therefore, the authors carried out an exploratory study to fill in this gap. In this study, 274 students, who were at different stages of study at a university, were taught using a mobile phone-based SRS and a polling web site. A subsequent online survey based on the Technology Acceptance Model was conducted. It was found that the students showed high perceived usefulness (PU) and high perceived ease of use (PE) on the SRS, despite their differences in their stages of study. This study showed that the mobile-phone based SRS is feasible in the university's environment. This study also found internally reliable constructs for measuring the PU and PE in the TAM.

INTRODUCTION

To achieve effective and efficient learning, student engagement is essential, but not easy to achieve. The lack of student engagement is often an obstacle to achieving the learning outcomes (Micheletto, 2011; Wang, Shen, Novak, & Pan, 2009). If all students give answers to quizzes or polls in class, the teachers can discover excellent ideas or misconceptions. However, when the teacher calls on volunteers to answer a question, there may not be much useful feedback to the teacher. It is because only the most confident students will volunteer to answer questions and engage in discussions. Therefore, the teacher only obtains feedback from a few students who are likely to know the correct answers.

As digital technologies continue to improve and become more economically viable to students and schools, much research has been done to exploit them to increase student engagement (Jungsun & Kizildag, 2011; Liu & Chen, 2015). In particular, many researches focus on the benefits and challenges of using the SRS (Student Response System) inside the classroom. In a SRS, the teacher posts a question on the projector screen and students can send their answers to the teacher's computer using custom-built devices, called "clickers", or more recently, their own mobile phones. Then the software automatically summarises answers from students and show the results to the teacher and students. This enables the teacher in the classroom to immediately

gain assess the understanding of the students so as to provide instant feedback and adjust the pace of teaching accordingly (Carnaghan, Edmonds, Lechner, & Olds, 2011; McLoone, Villing, & O'Keeffe, 2015; Monk, Campbell, & Smala, 2013; Valle & Douglass, 2014).

In summary, a SRS enables the teacher to answer questions in the classroom and get immediate feedback from the students using small handheld digital devices. Figure 1 shows the a screen of an SRS used by author for this study. A detailed explanation of the mechanism of the SRS will be described in a later section.

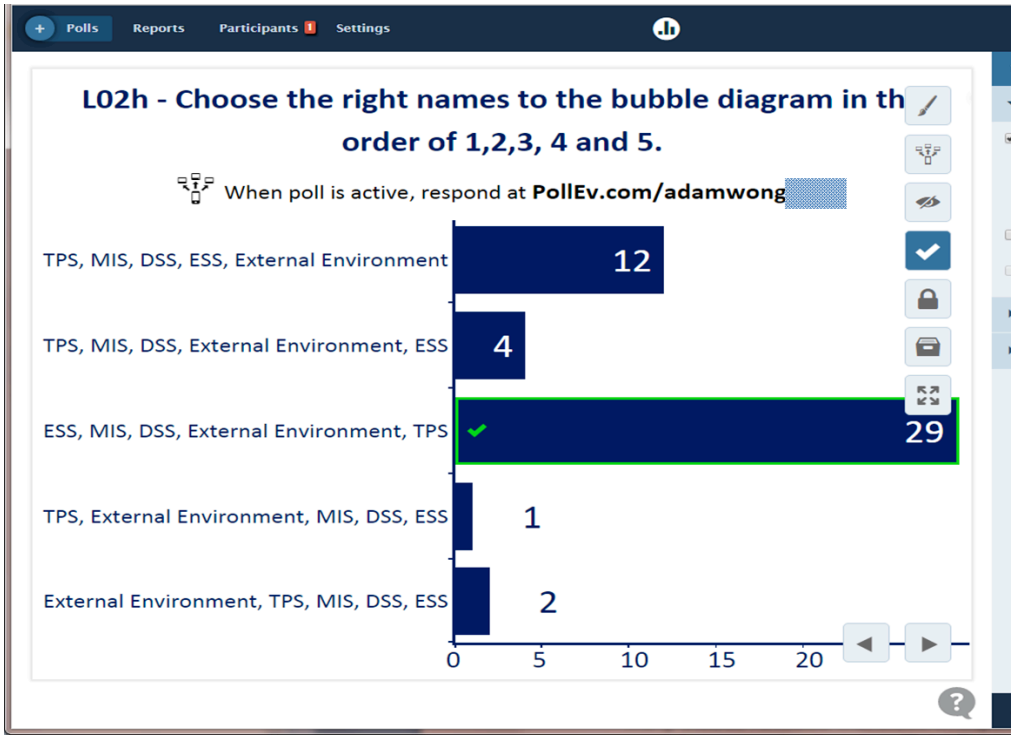

Figure 1: *The result of student answers displayed by a SRS software*

The structure of this article is as follows. Firstly, we will begin by reviewing the mechanism and advantages of the clicker-based SRS. Secondly, we will review the literature regarding the mechanism of the mobile phone-based SRS and its advantages over the traditional SRS. Thirdly, the Technology Acceptance Model, on which the survey questionnaire was based, will be described. Fourthly, we will set the scene for this study by describing the institutions in which the study was conducted. Then we will present the methodology, data and the findings of our study. Finally, we will conclude the results of this study and make some suggestions for future research.

STUDENT RESPONSE SYSTEMS (SRS)

In a typical SRS, students are given small, portable devices called “Clickers” (Lindquist et al., 2007). The clicker, as shown in Figure 2, has numeric keys, on which students can choose their answers to the questions posted by the teacher. Then the student answers are summarised and shown on the projector screen immediately. The mechanism of the clicker-based SRS is shown in

Figure 3. The main advantage of an SRS is that it allows the teacher to quickly find out how well each student understands a subject immediately. This is because students are not afraid to answer questions as the whole class can only see the statistics of the different answers, but not who gave the answers. When the teacher gets the immediate feedback, he or she can adjust the pace of the teaching accordingly. Therefore, the SRS is more effective and efficient than traditional raise-of-hand polls in creating an engaging learning environment.

Figure 2: *A typical clicker. Source: Turning Technologies (2015)*

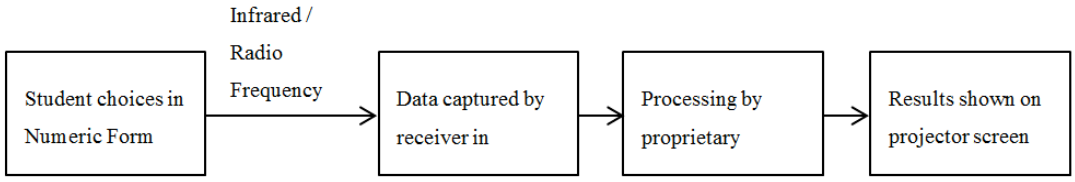

Figure 3: *The mechanism of the clicker-based SRS*

However, clickers are limited to making choices in the form of numbers, and students are not willing to use them if they have to pay for the clickers (Monk et al., 2013). Due to the widespread use of mobile phones in Hong Kong, and the availability of free WIFI access on campus, and commercially available polling software, mobile phones become a viable alternative to proprietary SRS using “clickers”.

MOBILE PHONE-BASED SRS

Compared with the clicker, the mobile phone is an attractive alternative because of its small size and high penetration rate among students. Research has found that most of the students in higher education own a mobile phone (Burns & Lohenry, 2010; Gikas & Grant, 2013; Liu & Chen, 2015; Shon & Smith, 2011). Therefore, the mobile phones can be an effective substitute for clickers. The mechanism of the mobile phone-based SRS is shown in Figure 4.

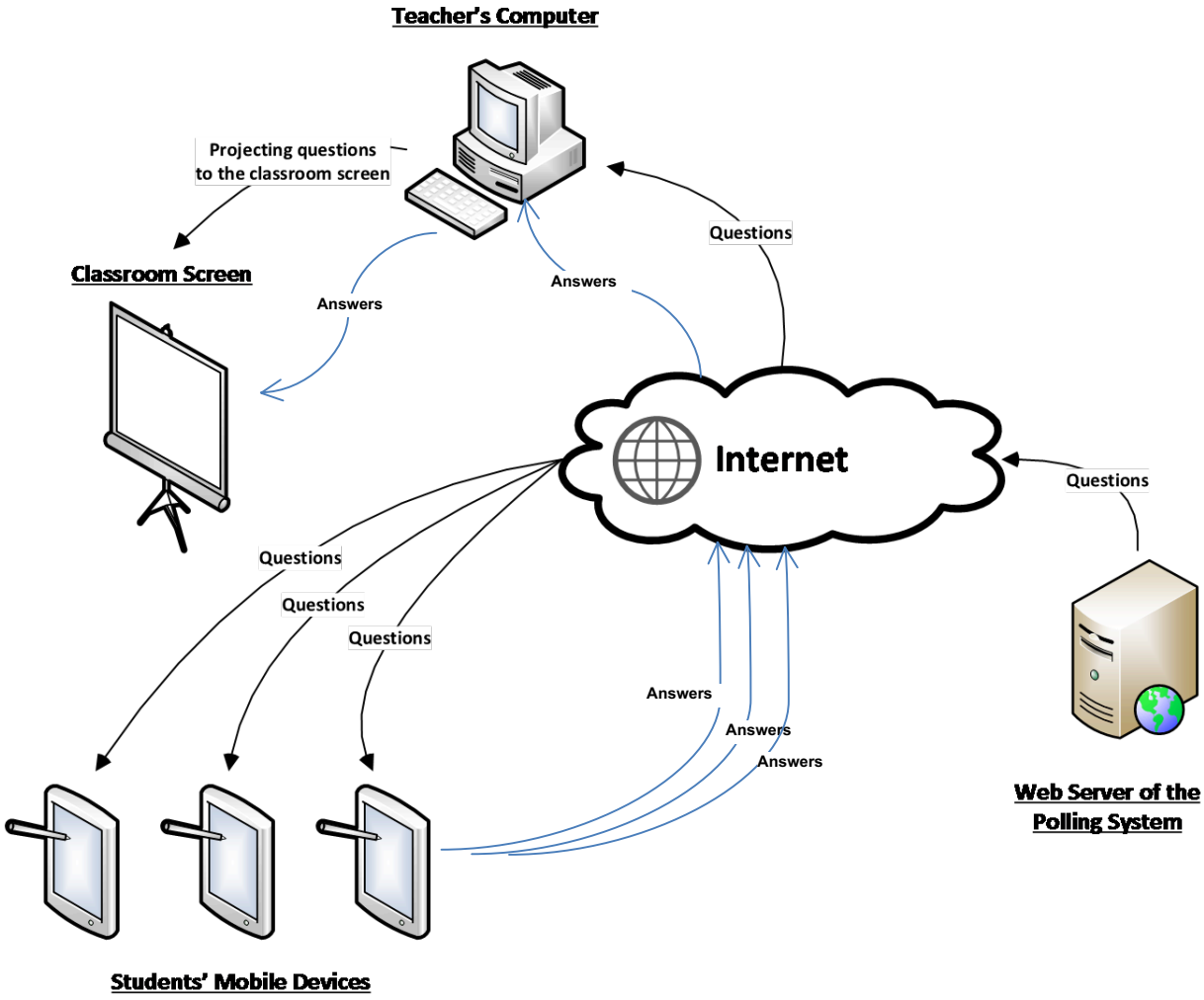

Figure 4: *The mechanism of the mobile phone-based SRS*

A comparison of Figure 3 and Figure 4 shows that the clicker-based SRS requires the installation of a receiver in the classroom, while the mobile phone-based SRS uses the Internet as the connection medium. This means the teacher has more flexibility because the teacher can use the SRS in any classroom that has WIFI coverage. Furthermore, the polling website and subscription fees according to the class size and the features required. The other advantages of the mobile phone over the other devices are summarised in Table 1. However, it is important to note the mobile phone can be a distraction when students use them in the classroom (Gikas & Grant, 2013).

Mobile phones are less expensive to operate. Some schools require their students to purchase clickers, or pay a deposit which will be returned at the end of the term. This adds costs and effort to the students and the school (Lindquist et al., 2007). Since clickers have no other use other than provide answers in the classroom, students may forget to bring them to class (Withey, 2010). When students forget to bring them or if the clicker malfunctions, there is nothing they can do about it. If the teacher has to distribute the clickers in class, they have to carry a bulky box. On

the other hand, most students already have mobile phones. Mobile phones incur no extra charge when they used in connection with WIFI. However, as it has been reported that students who used mobile phones as an SRS device may experience connection problems (Stowell, 2015).

Table 1: *Comparing the Clicker-based SRS and the Mobile Phone-based SRS*

	Clicker	**Mobile Phone**
Networking Technology	Infrared, Radio Frequency	Cellular Network, WIFI
Cost	Hardware, Software, Maintenance	Subscription to polling software or limited access for free
Functionality	Numeric Choices	Numeric Choices, Text messages, Clicking Images, Upload Photos
Portability	Limited to the classroom	Can be used inside and outside the classroom
Anonymity	Not easy to achieve	Can be achieved easily
Convenience	Small size, easy to carry, light weight	Small size, easy to carry, light weight

Mobile phones have more functionalities than clickers. Clickers are typically limited to numeric inputs using a small keypad. Therefore, they are limited to doing simple multiple choice questions. Awkwardness of text entry encourages students to provide a minimal answer. For example, using “n” instead of “and”; or provide no explanations to answer at all. Some more sophisticated clickers allow text entry, but they are more expensive (Lindquist et al., 2007). On the other hand, mobile phones allow students to can enter text very efficiently on a virtual keyboard. Thus the students are more responsive to open-ended questions. Some polling software allows users to click directly on graphics as answer to questions (Wong, 2016). This reduces the possibility of error in selecting a choice when choosing a number that represents part of a graphic. Mobile phones are small enough to be used in the classroom without adversely affecting notes taking (Lindquist et al., 2007).

Anonymity is more efficiently achieved using mobile phones than clickers. Clickers are often issued to students by the school. Because each clicker has a unique code which is included in the signal that it sends out, the students might worry that the school can track their answers. This prohibits them to reveal their true opinions or behaviours in certain questions (Caldwell, 2007). When the answers to some questions that are strictly confidential, such as those related to unethical behavior, special measures must be taken to let the students have the assurance that their answers are indeed anonymous (Gikas & Grant, 2013). For example, the teacher would have to let students choose their clickers randomly from a set of clickers. On the other hand, mobile phones are owned by the students. The teacher can choose not to require students to log in before answer questions. Thus, anonymity is ensured efficiently.

LITERATURE REVIEW

To compare the relative amount of research on use of clicker-based and mobile phone-based SRS, we searched for peer-reviewed academic journal papers an education-related academic database - the ERIC (Educational Resources Information Center) database. The ERIC database is chosen because of it is focused on education. It is sponsored by the U.S. Department of Education to provide extensive access to educational-related literature. The ERIC database provides access to some 14,000 documents and over 20,000 journal articles per year. Besides journal articles, it also provides coverage of conferences, meetings, government documents, theses, dissertations, reports, audiovisual media, bibliographies, directories, books and monographs (Repko & Szostak, 2016).

Since the SRS has many other names such as Polling Systems, Audience Response Systems, Personal Response Systems, Classroom Response Systems and Student Response Systems, we searched for academic journal articles that contain the word "polling" or the exact phrase "response system*". The use of the wildcard character "*" in the criterion *"response system*"* meant that articles containing the phrase "response system" (in singular form) or "response systems" (in plural form) in the abstract will be found. Then we narrowed down the results by including only articles that contained the words "phone" or "mobile" or "smart" anywhere in the article. The search criteria and results are shown in the following list:

- 372 articles contained "polling" or "response system*" in the abstract
- 20 of which contained "phone" or "mobile" or "smart" anywhere in the article
- 7 of which are research articles involving the use of mobile phones in an SRS

After reading the abstract of the 20 articles, only 7 of them are related to using mobile phones as part of a student response system. These 7 articles are shown in Table. Although the literature survey above is by no means exhaustive, it did indicate the relative little research conducted on using mobile phones as part of the SRS. This article serves to add to the research about mobile phone-based SRS. Furthermore, it will also investigate if there is any difference in perception by students from different stages of a four-year university curriculum.

The researches listed in Table 2 are briefly described here. Huang et al. (2015) created their own mobile phone-based SRS by developing their own software. This approach is only limited to teachers who have enough system development expertise and resources. Likewise, Stav et al. (2010) developed their own SRS for iPod Touch and iPhones. Furthermore, such self-developed systems are likely to lack flexibility and technical support that are essential for adoption by other teachers. Lee et al. (2013) and Goh and Hooper (2007) eliminated the need for students to use a smart phone by developing an SRS that is based on SMS (Short Message Service). The SMS-based SRS would work for any mobile phone that can support SMS. This approach not only required system development expertise and resources, but also limited the answers of students to text only. Habel and Stubbs (2014) used a commercially available polling website to form their SRS, in which students submitted their answers using their mobile phones. They found that student response systems are useful in increasing student engagement in large law lectures. At the same time, they pointed out that there was a need to research on the types of students who prefer to use SRS.

Despite the versatility and ubiquity of the mobile phone, the student's preference between the clicker and mobile phone is also controversial. On one hand, Hwang et al. (2015) found that most students favoured the use of traditional clickers over mobile phones, with the students reporting a number of difficulties in using the latter. On the other hand, Lam, Wong, Mohan, Xu, and Lam (2011) reported students who used mobile phones as devices in an SRS tended to report more positively than used traditional clickers. This is consistent with the findings by Arnesen et al. (2013). The study by Arnesen et al. (2013) found that when students were allowed to choose

between borrowing an iPod or using their own mobile phones, more than 80% of the students preferred to use their own mobile phones. Stowell (2015) reported a similar finding. This article is an attempt to contribute to knowledge on SRS which is formed by student's mobile phones and commercially available polling web sites.

Table 2: *Peer-reviewed academic journal papers in ERIC that matched the search criteria*

Authors	Location	Device	Focus / Major Findings
Arnesen, Korpas, Hennissen, and Stav (2013)	Norway	Mobile devices	Students could choose between borrowing an iPod or using their own smartphone. As a result more than 80 % preferred to use their own equipment.
Goh and Hooper (2007)	New Zealand	SMS	Describes the potential use of a mobile phone Short Message Service (SMS) crossword puzzle system to promote interaction through learning activities in a large classroom environment.
Habel and Stubbs (2014)	Australia	VotApedia	It was implemented in tandem with constructivist pedagogies such as explicit pre-reading and a prior context of interactive lecturing. Data were collected through observation, via mobile phone voting in class and by an online survey
Huang, Chen, and Weng (2015)	Not stated	Mobile phone	Developed a multi-media mobile classroom feedback system (MMCFS)
Hwang, Wong, Lam and Lam (2015)	Not stated	Clickers vs mobile device	Found that student's preferred clickers over mobile phones.
Lee et al. (2013)	Hong Kong	SMS	Collects and analyzes the answers or opinions sent in by the students as SMS (short message service) messages.
Stav, Nielsen, Hansen-Nygard, and Thorseth (2010)	Europe	iPod Touch, iPhone	Developed an SRS involving a set of XML technologies, web services and modern mobile devices.

Our study will investigate student's perception based on two constructs – perceived usefulness and perceived ease of use. A review of the literature listed in Table 1 shows there is no research in this sample of journal articles that compared the students learning experience according the different stages of their study. It is important for teachers to know if there are differences in the acceptance of the SRS between the younger and older full-time students. Since the mobile phone is capable of visiting social networking website and playing games, there is the possibility of distraction when students use them in the classroom.

Through a qualitative study, Gikas and Grant (2013) found that older students may consider the mobile phone less distractive as younger students. Therefore, a particular focus of this research is the comparison of student perceptions on the SRS across the different years of study in a four-year university curriculum. At the university in which the study was conducted, all students in the sample were full-time students. Therefore, there would be very few students who were further

along in their studies than the older students. This study will help to answer the question of whether the SRS is suitable for all full-time students across a four-year curriculum.

THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

The TAM was developed by Davis (1989) to explain the acceptance of technology by users in organizations. The TAM proposes that the use of technology is determined by an individual's attitude towards using the technology, which is a function of their two beliefs. Those two beliefs are called Perceived Usefulness (PU) and Perceived ease (PE) of use respectively. They are the key predictors of actual behaviour in adopting a technology-based product or service (Davis, 1989). PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p.320). PE is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p.320). In this study of the SRS, the users are the students, and the organization is the school.

TAM has been used in studies related to e-Learning using mobile devices such as in that carried out by Park, Nam, and Cha (2012). Since this is an exploratory study in the author's school in Hong Kong, we followed the approach of Chen and Lan (2013) by limiting the number of questions in the survey to six only. If the SRS proved to be feasible in this context, further research will be carried out using more detailed survey questionnaire and bigger samples. The complete model of the TAM includes behavioral intention and actual behavior. In the context of SRS, the behavior is controlled by the teacher, so the behavioral intention and behavior are not included in this study.

The items for measuring PU and PE were based on the feedback from students during the Scheme Executive Group Meeting. The meeting was part of the quality assurance mechanism of the schools involved and was held in the middle of each semester. Teaching staff and representatives of students were given opportunities to make comments on their teaching and learning experience at the school. The questions for PU are listed below as PU1, PU2 and PU3.

- It is interesting to know the answers from all my classmates through SRS (PU1).
- Answering questions using SRS helps me to maintain my attention (PU2).
- Answering questions using SRS makes the lessons more interesting (PU3).

The questions for PE are listed below:

- I don't need to download special software to use SRS (PE1).
- I don't need much effort to use the SRS website (PE2).
- It is easy to answer questions using SRS (PE3).

SETTING THE SCENE

The subjects in this study are students of two self-financing units of the Hong Kong Polytechnic University. The first unit is the Hong Kong Community College (HKCC) which offers associate degrees (AD) to secondary school graduates. The normal duration of an AD is two years. They are equivalent to year one and year two in a four-year university curriculum. HKCC has 7000 students and 210 teaching staff. The second unit is the School of Professional Education and Executive Development (SPEED). SPEED offers top-up degrees (TD) to AD graduates. The normal duration of a top-up degree is two years. They are equivalent to year three and year four in a four-year university curriculum. SPEED has 4400 students and 227 teaching staff. The students in the samples of this study are taken from year 1 of the associate degree, year 1 of the top-up degree and year 2 of the top-up degree. The authors purposely select only students who were taking IT as their major. This would minimize student anxiety when they were asked to

answer questions using their mobile phones. Besides, the students were informed that the answers they submit through the SRS only formed part of their participation marks for the subject. The participation marks was 10% of the overall subject grade.

As the combined student population of both units is over 10,000, the results of this research will provide important information on the feasibility and value of the mobile phone-based SRS to the students.

METHODOLOGY

Following the approach taken by Habel and Stubbs (2014), we formed a mobile phone-based SRS using a commercially available audience response system (ARS) and the students' mobile phones. The teacher created the questions on the ARS before class time. During class, when the teacher chose a question for a poll, the question appeared on the mobile phones of students. Then students submitted their answers using their mobile phones. The campuses at which we were teaching provided free WIFI access to all students. This means students did not need to subscribe mobile data plans for answering polls in this course. There were no costs to the students who are subjects of this study. At the end of the semester, the students completed an online survey. The students completed the survey on a voluntary and anonymous basis.

For the two semesters in the academic year of 2015/2016, we tried the SRS in three groups of full-time students who are at different stages of their study. At the end of the semester, an online survey was conducted for each group. A total of 179 responses were received. Seven of the responses were rejected due to incomplete answers. The number of students at each stage of study and the response rates are shown in Table 3.

Table 3: *Number of students at each stage of study and the response rates*

Degree	Stage of Study	Subjects	Percentage of Multiple Questions	Number of Students	Replies to Survey	Response Rate
AD	Year 1	Applied Computing, Introduction to Internet	85%	165	75	45%
Top-up	Year 3	Management Information Systems	90%	40	39	98%
Top-up	Year 4	Internet Marketing, E-commerce	80%	69	58	84%
Total				**274**	**172**	**63%**

The survey asked the students six questions regarding the perceived usefulness and perceived ease of use of the mobile phone-based SRS. These questions are related to Perceived Usefulness (PU) and Perceived Ease of Use (PE), the two basic constructs in the Technology Acceptance Model (TAM). The questions and the results of the survey are shown in Table 4.

Table 4: *Questions in the Survey, Cronbach's Alpha and Combined Ratings*

Construct	Measuring Items (1="Strongly Agree", 2="Agree", 3="Neutral", 4="Disagree", 5="Strongly Disagree")	Cronbach's Alpha	Combined (n=172)	
			Mean	Standard Deviation
Perceived Usefulness (PU)	It is interesting to know the answers from all my classmates through SRS (PU1).	0.872	4.0969	.72254
	Answering questions using SRS helps me to maintain my attention (PU2).			
	Answering questions using SRS makes the lessons more interesting (PU3).			
Perceived Ease of Use (PE)	I don't need to download special software to use SRS (PE1).	0.880	4.0523	.78599
	I don't need much effort to use the SRS website (PE2).			
	It is easy to answer questions using SRS (PE3).			

FINDINGS & DISCUSSIONS

The polling web site worked well during the study. The phone reception was good and no students experienced problems with connectivity. However, some students experience difficulty in scanning the QR (Quick Response) code or manually entering the URL for the polling website. The online survey at both institutions received 179 responses. After discarding seven incomplete entries, there were 172 valid responses in total. There were 75 responses from the associate degree (AD) students and 97 responses from the top-up degree students. The total number of students in both classes was 274. The overall response rate was 63%. The data were analyzed using SPSS v23.

Internal Reliability of Combined Items

In the survey, there were three questions each for the constructs of perceived usefulness (PU) and perceived ease of use (PE). The students give a rating on a five-point Likert scale, in which "1" stood for "Strongly Disagree", "2" stood for "Disagree", "3" stood for "Neutral", "4" stood for "Agree" and "5" stood for "Strongly Agree". The reliability of the questions for the constructs were tested by the Cronbach's Alpha. The questions for the constructs, their ratings and the Cronbach's Alpha were shown in Table 4. The Cronbach's Alpha for the questions that measured PU and PE were 0.872 and 0.880 respectively. Since they were greater than the 0.8, the internal consistencies of the items were considered as very good (Hair, 2011, p. 235).

The student ratings for the questions for each construct were combined to form a combined rating for each construct. The mean of the combined rating for PU was 4.0969 and that for PE was 4.0523. All the combined means were very close to, or greater than 4, when the maximum possible combined mean is 5. The results showed that the students had positive perceptions about the usefulness and ease of use on the mobile phone-based SRS.

Data Distribution

The Kolmogorov-Smirnov and Shapiro-Wilk tests were run to test if the data were normally distributed. As shown in Table 5, Table 6, and Table 7, the significance value of the tests based

on gender, award degree and year-of-study are all less than 0.05. This means that the data were not normally distributed.

Table 5: *Tests of Normality based on Gender*

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PU	Male	.165	127	.000	.883	127	.000
	Female	.207	45	.000	.890	45	.000
PE	Male	.171	127	.000	.885	127	.000
	Female	.157	45	.007	.903	45	.001

a. Lilliefors Significance Correction

Table 6: *Tests of Normality based on Award Degree*

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PU	Associate Degree	.215	75	.000	.858	75	.000
	Top-up Degree	.155	97	.000	.906	97	.000
PE	Associate Degree	.204	75	.000	.852	75	.000
	Top-up Degree	.148	97	.000	.919	97	.000

a. Lilliefors Significance Correction

Table 7: *Tests of Normality based on Year-of-Study*

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PU	1.00	.215	75	.000	.858	75	.000
	3.00	.145	39	.039	.866	39	.000
	4.00	.202	58	.000	.936	58	.004
PE	1.00	.204	75	.000	.852	75	.000
	3.00	.201	39	.000	.870	39	.000
	4.00	.146	58	.004	.931	58	.003

a. Lilliefors Significance Correction

The main reason for the data not being normally distributed is because the histogram is highly skewed to the right. For example, as the histogram in Figure 5 shows, many students gave high ratings to the questions representing the construct of perceived usefulness. Therefore, non-parametric tests were performed in the following paragraphs in which the ratings across the different groups are compared. The Mann-Whitney U test was used for comparison across the groups in Gender and Award Degrees. The Kruskal-Wallis was used for comparison across the groups in years-of-study, because there were more than two subgroups.

The Mann-Whitney U test and the Kruskal-Wallis test were used instead of the ANOVA was because data distribution in the samples. The ANOVA assumes that the data has a normal

distribution, while the Mann-Whitney U test and Kruskal-Wallis test do not assume normality (Carver & Nash, 2011). These tests rank all the observed scores in the sample in each group. If real underlying differences among the groups exist, then scores from the various groups will be systematically clustered in the entire rank order (Carver & Nash, 2011). Since only the ranks are used instead of the actual values, this test does not require the underlying distribution of the data to be a normal distribution.

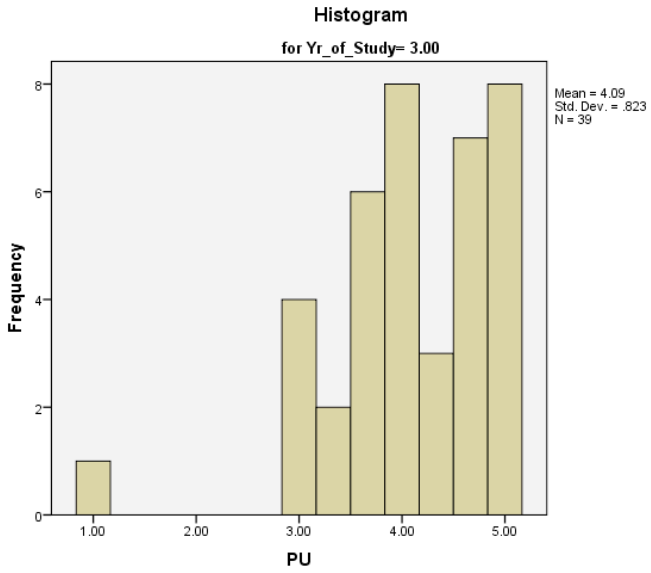

Figure 5: *Histogram of Response from Year 3 Students on Perceived Usefulness Mobile Phone Ownership*

The device that the students used to answer questions in the polls and the number of mobile devices they own are shown Figure 6 and Table 8 respectively.

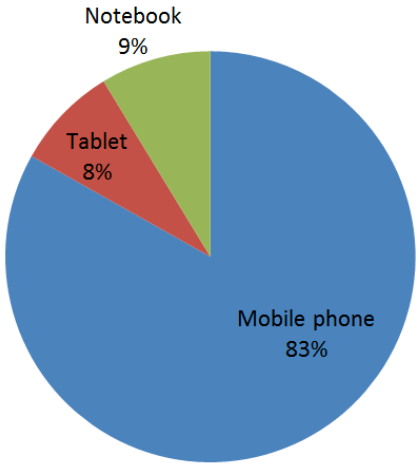

Figure 6: *Devices That Students Used to Answer Questions in The Polls*

It shows that although more than half of the students owned more than one mobile device, the majority (83%) of them selected to bring and use the mobile phone to answer questions in the polls. Only a few students used the tablet (8%) and notebook computer (9%) to answer questions in the polls. This is consistent with the explanation given by Lindquist et al. (2007), which stated that compared with the tablet and the notebook computer, the mobile phone was lighter in weight to bring to school, and smaller in size so that it would not take up too much desk space.

Table 8 shows that 2% of the students reported that they did not own a mobile device. This implied that those students either didn't take part in the polls or they borrowed a mobile device to do the polls. Although at HKCC & SPEED, students can borrow notebook computers for one day, it implies that the teacher must provide a backup channel for students submit answers in the polls, and that teacher must not attach too high a percentage to the polls as part of the subject assessment.

Table 8: *Number of Mobile Devices Owned by the Students*

Number of Mobile Device(s) owned	Number of Students	Percentage (n= 172)
0	3	2%
1	76	44%
2	57	33%
3 or more	22	21%

Differences in Perceptions due to Gender

There were 127 male students and 45 female students in the survey. The ratings for PU and PE given by the male and female students are shown in Table 9. While both male and female students have positive perceptions about the usefulness and ease of use on the mobile phone-based SRS, the male students had given slightly higher ratings than the female students. The male students rated the PU and PE of the SRS as 4.1969 and 4.1312 respectively, while the female students rated the PU and PE at 3.8148 and 3.8296 respectively. To find out whether there is an underlying difference between the male and female students, the Mann-Whitney U test was carried out. The results of the test are shown in Table 10.

Table 9: *The Mean of The Ratings Given by the Male and Female Students*

	Gender	N	Mean	Std. Deviation	Std. Error Mean
PU	Male	127	4.1969	.67502	.05990
	Female	45	3.8148	.78353	.11680
PE	Male	127	4.1312	.75026	.06657
	Female	45	3.8296	.84871	.12652

Table 10: *Independent Samples t-Test on Gender*

	PU	PE
Mann-Whitney U	1981.000	2269.000
Wilcoxon W	3016.000	3304.000
Z	-3.126	-2.098
Asymp. Sig. (2-tailed)	.002	.036

a. Grouping Variable: Gender

For PU, the significance value for the mean difference between the genders is 0.002. Since it is smaller than 0.05, there was a significant difference between the genders. It means that the male students had slightly more positive perceptions on the usefulness on the mobile phone-based SRS. For PE, the significance value for the mean difference between the genders is 0.036. Since it is smaller than 0.05, there was a significant difference between the genders. It means that the male students had slightly more positive perceptions on the ease of use on the mobile phone-based SRS.

The implication is that if the teacher is using the SRS in a class that is predominantly female, such as in an art class or in a girl school, the teacher has to spend more time to explain the purpose and procedure of using the SRS.

Differences in Perceptions due to Award Degree

We reviewed the possible difference caused by difference in stages of study in two ways. Firstly, we looked for difference, if any, between the top-up degree and associate degree students. Secondly, we looked for difference, if any, among the groups of students who are at Year-One, Year-Three and Year-Four of a four-year curriculum.

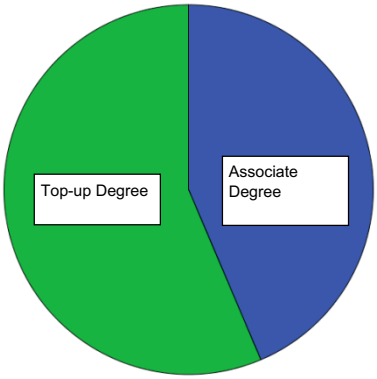

Figure 7: *Distribution of students between Top-up Degrees and Associate Degrees*

There were 75 associate degree (AD) and 97 top-up degree (TD) students in the survey. The distribution of students in the two different degrees is shown in Figure 7. The mean rating for PU and PE given by the two groups of students are shown in Table 11.

Table 11: *Means of The Ratings Given by the Associate degree and Top-up degree Students*

	Stage	N	Mean	Std. Deviation	Std. Error Mean
PU	Associate Degree	75	4.1644	.76988	.08890
	Top-up Degree	97	4.0447	.68318	.06937
PE	Associate Degree	75	4.1156	.82472	.09523
	Top-up Degree	97	4.0034	.75537	.07670

It can be seen that while both AD and TD students had positive perceptions about the usefulness and ease of use on the mobile phone-based SRS, the AD students had given slightly higher ratings (PU=4.1644 and PE=4.1156) than the TD students (PU=4.0447 and PE=4.0034). To find out whether there is an underlying difference between the two groups, the Mann-Whitney U Test was carried out. The results of the test are shown in Table 12.

Table 12: *Mann-Whitney U Test on Associate degree and Top-up degree Students*

	Award	N	Mean Rank	Sum of Ranks
PU	Associate Degree	75	93.21	6990.50
	Top-up Degree	97	81.31	7887.50
	Total	172		
PE	Associate Degree	75	91.63	6872.00
	Top-up Degree	97	82.54	8006.00
	Total	172		

	PU	PE
Mann-Whitney U	3134.500	3253.000
Wilcoxon W	7887.500	8006.000
Z	-1.590	-1.215
Asymp. Sig. (2-tailed)	.112	.225

For PU, the significance value for the difference between the TD and AD students is 0.112. Since it is larger than 0.05, there was no significant difference between the degrees regarding PU. It means that the TD and AD students had same positive perceptions on the usefulness on the mobile phone-based SRS. For PE, the significance value for the mean difference between the TD and AD is 0.225. Since it is larger than 0.05, there was no significant difference between the TD and AD students in their perceptions on PE of the SRS. It means that the TD and AD students had the same positive perceptions on the ease of use on the mobile phone-based SRS.

Differences in Perceptions due to Year-of-Study

In the survey, there were 36 students in Year-One, 39 students in Year-Three and 97 students in Year-Four. The distribution of the students according to year-of-study is shown in Figure 8. The mean ratings and descriptive statistics for PU and PE given by the three groups of students are shown in Table 13, Table 14 and Table 15. It can be seen that all three groups of students had given high ratings to the PU and PE on the mobile phone-based SRS. All the ratings were above 4 out of a scale of 5, except for the rating for PE given by Year-Four students, which is 3.9828. However, there are some apparent differences in the ratings among the years of study. The Year-

One students gave the highest ratings for both constructs (PU=4.1644 and PE=4.1156), while the Year-Three TD students gave the second highest ratings both in PU and in PE (PU=4.0855 and PE=4.0342), and the Year-Four students gave the lowest ratings to both constructs (PU=4.0172 and PE=3.9828). It looked as if there was a pattern of decreasing perception on PU and PE as the year-of-study increased. To find out whether there is an underlying difference between the three groups, the Kruskal-Wallis test was carried out.

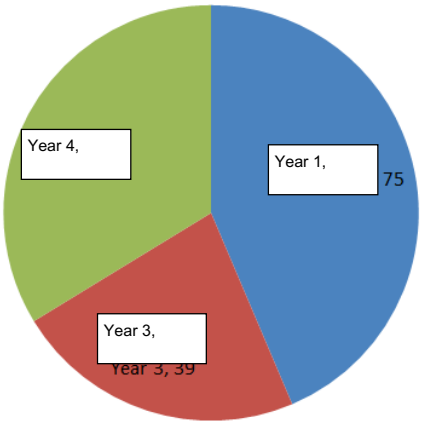

Figure 8: *Distribution of students according to year-of-study*

Table 13: *Mean of The Ratings Given by the Year-One students*

	N	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error
PU	75	4.1644	.76988	2.612	.548
PE	75	4.1156	.82472	1.986	.548
Valid N (listwise)	75				

Table 14: *Mean of The Ratings Given by the Year-Three students*

	N	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error
PU	39	4.0855	.82263	3.708	.741
PE	39	4.0342	.82290	3.525	.741
Valid N (listwise)	39				

Table 15: *Mean of The Ratings Given by the Year-Four students*

	N	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error
PU	58	4.0172	.57709	.346	.618
PE	58	3.9828	.71307	-.778	.618
Valid N (listwise)	58				

Table 16: *Mean Ranks of the Groups by Year-of-Study*

	Yr of Study	N	Mean Rank
PU	1.00	75	93.21
	3.00	39	86.81
	4.00	58	77.62
	Total	172	
PE	1.00	75	91.63
	3.00	39	87.06
	4.00	58	79.49
	Total	172	

The Kruskal-Wallis test results are shown in Table 17. The asymptotic significance values for PU is 0.186 while that for PE is 0.361. As all significance values are greater than 0.05, therefore, it is concluded that there were no significant differences in perceptions among the groups of students in their Year-One, Year-Three or Year-Four of study. It follows that the students at Year-One, Year-Three and Year-Four in the sample all had positive perceptions on the mobile phone-based SRS.

Table 17: *Kruskal-Wallis test with the Year-of-Study as the grouping variable*
Test Statistics[a,b]

	PU	PE
Chi-Square	3.360	2.040
df	2	2
Asymp. Sig.	.186	.361

a. Kruskal Wallis Test
b. Grouping Variable: Yr_of_Study

CONCLUSION

This exploratory study shows that at the two institutions from which the samples were drawn, the SRS is technically feasible and perceived positively by students who majored in IT. It was also found that the students showed high perceived usefulness and high perceived ease of use on the mobile phone-based SRS, despite their differences in the award of degrees and stages of their study. The three proposed items for measure each of the constructs in the TAM were found to be internally reliable.

It is suggested that both institutions involved in this study should proceed further, with caution, in adopting SRS in more classes and in more disciplines of study such as business management, language studies and social sciences. As a few number of students indicated that they didn't have any mobile devices, the teacher must provide some alternative channels for those students to answer the questions. This may include using pen-and-paper exercise or loaning of tablets to these students.

One of the limitations of this study is that there is not a complete range of year of study. Therefore, future study should also include the use of SRS in subjects at Year 2. Another limitation is the size of the classes. After the pilot proved that the student acceptance of the technology and its technical feasibility, it is suggested future research be done with large classes that are of size 100 or over. It is also suggested a longitudinal study be done to track the perception of the students who have been exposed to the use of SRS over a period of time.

We also suggest that future research be carried to verify its external reliability. Further research can also try to investigate the factors that contribute to the constructs of PU (perceived usefulness) and PE (perceived ease of use) in the TAM.

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