

# Exploring the Use of Smartphones as Clickers

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## Abstract

Clickers or Quick Response Systems (QRS) have been used widely in classrooms for different purposes. However, no research has explored the use of smartphones when they are used as clickers instead of dedicated hardware devices. With their wide spreading among students and educators nowadays, it is possible that smartphones can be used in the classroom easily as clickers using applications or via the web. The main purpose of this study is to provide a preliminary assessment on the use of smartphones as clickers. Students' views on their satisfaction, performance, participation, feedback, and ease of use of smartphones as clickers were surveyed with the help of a 9-statement survey with 5-point Likert scale. Teachers were also interviewed to know their opinions about the use of smartphones as clickers in their classrooms. Their functionality, features and user experiences are investigated. The collected data was analyzed with the help of descriptive statistics (means and standard deviations). The use of smartphones as clickers found to be beneficial for teachers and students. The familiarity with the technology made it easy for participants to take more active part in the classroom work which was reflected in their learning outcomes. Further, the positive attitudes regarding the use of smart phone as QRS devices were also noticed. The overall experience of teachers regarding the tool was reported in the study and found to be promising.

**Keywords:** Smartphones, Clickers, Active Classroom, Active learning, QRS

## 1. Introduction

For the past two decades, educators have managed to extensively adopt and equally exploit clicker technology in classrooms (Keough, 2012). As the popularity of these learning instruments increases, so has the interest of academics and researchers in studying their effectiveness and uses. Thus far, several experts have concluded that clickers are currently an important element in creating active learning environments (Sprague and Dahl, 2009). It is proven that clickers help stimulating the interaction between student and lecturer. Still, the use of smartphones as clickers, as a new emerging technology, needs to be explored and tested for efficiency, functionality, and student learning outcomes. That is exactly what the aim of the current research is.

## 2. Literature Review

### 2.1. Literature Review on Clickers

For a better understanding of the role of clickers in learning, it is important to carry out a background research. It is possibly best to start with the definition of clickers. According to Lyubartseva (2013), clickers are small, wireless hand-held gadgets employed in the learning/teaching processes. Teachers use clickers for several purposes. Firstly, to receive feedback from students by giving them the ability to respond to questions or polls or any other form of interaction. Secondly, students may rely on clickers during tests, answering questions on quizzes as well as self-assessment. Lately, clickers have been introduced to be used for course and instructor evaluations, recording of attendance, surveys and general feedback collection (Chan, and Knight 2010). Due to emerging mobile technologies and communication developments, instructors can receive information about their students' responses on their computers or smartphones. This allows them to take the proper actions based on feedback and responses during their lesson.

Next, it is important to clear the term of clickers and the different expressions used in current research literature. There are many names that are used in the research to refer to clickers in an educational setting including: Quick Response Systems (QRS), student response systems, etc. Clickers have gone through a great change since they were first introduced to classrooms using wired gadgets. Today, the cutting edge modern classroom technology allows educators to use quick response systems for web-based synchronized interactions. Some clickers are dedicated-hardware based, while others are software and/or web-based.

The most common question about clickers in an educational setting is whether or not they are capable of improving learning. Based on the existing research results regarding clickers, it is proven that this technology has positive impact on learning (Fike, 2012; Sanseverino, 2010). Benefits provided by clicker use include, but not limited to, immediate feedback of students understanding, increase in student performance and attention (Keough, 2012). Sanseverino (2010) states that clickers are able to increase the participation level of learners. He further states that clickers can also improve the attendance of students.

Clickers' application in the learning process has benefits to both the educators and learners. Blood and Gulchak (2012) presented and discussed several benefits of clickers in learning institutions. According to the researchers, the benefits for teachers include ease of assigning tasks, giving instructions, assessment, engagement

and involvement. Further, the adaptability of clickers makes it suitable to be used by disabled and challenged learners. On the other hand, the benefits for students include: clarification of big ideas as well as the main concepts, provision of immediate feedback, the ability to respond anonymously, the ability to increase participation, and that clicker tend to make learning more interesting. Literature also suggests that the most common, and probably the valuable application for the clicker technology is immediate feedback (Blood, 2010; Sanseverino, 2010).

#### 1.1.1. Benefits for Teachers:

Research has shown that clickers enhance student instruction by their teachers. This benefit is linked to the fact that clickers offer immediate response opportunities where teachers can take immediate actions to correct, review or re-teach concepts which seem to trouble their students (Mollborn and Hoekstra, 2010). Based on the results of the feedback obtained, teachers can be notified when and what the student have not understood. Clickers are effective evaluative tools for gauging the levels of understanding among the learners (Bojinova and Oigara, 2011). The ability to evaluate students on a regular or ongoing basis ensures that the teachers are able to establish areas of problem in time for action.

By using clickers, teachers increase the engagement and response rates in their classrooms (Martyn, 2007). In a nutshell, clickers increase the opportunities for responding to a single question. Every student in the classroom has the opportunity to participate in all clicker-based activities. Responses are graded and displayed instantaneously which help the teachers direct the class after that. The ability to have an immediate feedback on students' understanding alone should encourage teachers for increased clicker use (Keough, 2012). This capability also conserves instructional time in the classroom without having to sacrifice the amount learned; further increasing the educational value of clickers (Anderson et al., 2011).

Teachers have been found to have a positive attitude towards clickers for their flexibility/versatility as well as their ease of usage. The versatility of clickers is also an important factor. It is based on the fact that clicker technology is applicable across different fields and disciplines (Sternberger, 2012). They can also be used with different teaching styles and in various ways. This flexibility also makes clickers a teacher's favourite tool because it enhances instruction for all learners, with and without any forms of disabilities (Sanseverino, 2010). Challenged learners who may benefit from this technology include those who are easily distracted, with poor memories, those with short attention spans, deaf, also those with poor study skills.

#### 1.1.2. Benefits for Students:

One way in which clicker technology improves learning is by increasing participation (Blood and Gulchak, 2012). Clicker technology allows for each student to provide his or her own response to quizzes or questions posted in the system (Blood, 2010). In addition, clickers make the learning process a fun undertaking. With the current generation of learners being technologically advanced, many of them have used computers for the best part of their lives. Every day, they use gadgets such as iPad-s, iPod-s, smartphones, and so on; which tend to be very interactive. Likewise, this interactive setting can also be integrated into the learning process for better learning outcomes.

Clickers improve learning by making it possible for student to respond to questions anonymously (Blood and Gulchak, 2012). This is a major benefit for the shy or the self-conscious students who tend to feel embarrassed when it comes to giving their responses. The anonymity which may come with using clickers gives courage to such learners and avoids the issue of classroom conversation dominance by few students. The clickers ensure that each individual student's responses and opinions are heard. As stated by Blood and Gulchak (2012, p.249), "there has never been a more democratic tool for the classroom."

Clickers are very helpful in understanding and clarifying ideas and concepts. Learners come across a great deal of information, concepts, terms and definitions. This mass of information is hard to discern and digest. With clickers, it becomes easier grasp the main ideas as well as the connection between them.

This understanding about clickers has been supported by several other scholars such as Sanseverino (2010). He states that well-structured questions for clickers make it easier for learners to grasp concepts. On top of that, they also help them to explore further and deeper in order to understand the implications of these concepts and their extensions as well. Most importantly, they allow students present their own perceptions and compare them with those of others.

**Best Practices for Clicker Application:** To make the most out of the functionality of clickers, instructors ought to be aware of the best practices regarding their use. Bojinova and Oigara (2011) argue that for instructors to get the most out of these learning tools, the questions as well as the exercises must be aligned with the course's learning goals and objectives. In addition to that, clickers are best applicable in undertaking informal evaluation (Majerich et al., 2011). However, this does not mean that they cannot be applied in formal evaluation processes, like in high-stakes tests. Designing good questions is definitely an important asset that can make the use of clickers more effective. This view is supported by Sanseverino (2010, p.4) who states that each question ought to be in line with a "clearly pedagogically defined goal". Instructors should not just give out plain topics to be addressed. This will ensure that the instructors are able to achieve their target learning outcomes across the classroom.

## 2.2. *The Use of smartphones as Clickers*

The literature review of studies related to clicker use in classrooms revealed that research involving the use of smartphones as clickers was almost non-existent. This study tries to shed some light on the use of smartphones with their benefits when used as clickers and whether that they can offer any extra advantages or problems.

The quest to create a better and active learning environment has led experts to develop more advanced learning tools. According to the National Center for Education Statistics (2010), around 93% of the US schools had connectivity to the internet in 2009 and 53% has their wireless network. A recent initiative by President Barack Obama is aiming for faster internet in schools across the United States (Strauss, 2013), and the target for the next five years is 99 percent of students to be connected to the web through school networks (The Washington Post, 2013). The percentage of students who have smartphones in US colleges was 86 percent, according to a 2014 EDUCAUSE report. Nearly half (47 percent) owned a tablet. For instance, the constantly changing world of technology has seen smartphones used as clickers for educational purposes (Yee and Hargis, 2009). Although it is not the main functionality of these phones, educators and students have come to appreciate the educational importance of phones as clickers. As argued by Frantz (2011), it makes it possible to have classroom response systems without having to buy the clicker hardware, which makes them the cheaper option. With this innovation, educators are in a position to quickly obtain feedback from their students. In addition to that, they can rely on it to encourage the unenthusiastic learners and boost their participation. Some of the most common applications used to turn smartphones into clickers include Socrative and Poll-everywhere (Frantz, 2011). For students, smartphones may be preferred as clickers because of ease of use, popularity and their familiarity with technologies.

Smartphones can be used as Virtual Response Systems giving teachers opportunities to gather student responses from an online environment. Virtual clickers are web-based and don't depend on specific hardware. Users can engage the clickers using any device (Smart-phone, laptop, tablet, desktop computers) that can access the internet. Common features include attendance gathering, live polling, assessing student understanding (before/during/after sessions), gathering and giving feedback. Types of questions used in student assessment include but are not limited to multiple choice, True / False, Yes or No, fill in the blank, short answer, multiple choice and essay questions. Depending on the software, responses can be numeric, alphanumeric, graphical, textual, or algebraic. Each program provides a form of feedback such as bar graphs and pie charts which can be made visible to the participants. Other programs have more unique ways of presenting quizzes and feedback such as Space Race (running a quiz as a game) by Socrative, and Clicker School's Tug of War (splits your class into two teams and watch as the correct answers changes the tides of the game), QuestionRace (similar to Jeopardy), and EduRace (keeps students on the edge of their seat as they compete to answer questions while their cars race on screen).

Some software-based clickers allow a choice of anonymous responding, anonymous grouping, and identified responding. Other unique uses also are available such as Learning Catalytics's enabling students to review questions, even after the class session, as a study aid. Software such as Poll Everywhere Most allows students to pose open questions and comment on each other's work via a streaming wall or a word cloud. Most "clicker apps" have the same benefits, such as: good understanding of lectures, enhanced participation and collaborative learning, instant global feedback, easy availability of reliable data according to group or class, and simple way of gathering and immediate responsive analysis from students. Among other software-based products, only Socrative is free of charge, other products vary in their cost, depending on number of users and/or time of use.

Challenges: Although clickers are, without doubt, great learning tools, they also present a number of challenges. In line with the views presented by a number of researchers, clicker use also has challenges to both students and educators (White et al., 2011). Findings of the research indicate that there are some downsides and difficulties when using clickers including technical, logistical, and economical related issues. Some of these issues include fear of losing clickers, remembering to bring them to the class, having a small or difficult-to-read screen, risk of damage or scratches, and time taken to pass out and collect them during the class (Keough, 2012).

From instructors' perspective, clickers tend to be a significant investment in terms of time consumed. It may take a significant amount of time for the instructors to come up with effective clicker systems. They may also require some assistance when it comes to designing good questions since this can be instrumental (Kenwright, 2009). On the other hand, clickers are also a weighty investment on the students' part. Keough (2012) reported that one of the weaknesses of using clickers by students, as well as by teachers, is the fact that there is a substantial initial cost involved.

In addition to that, it is also important to acknowledge the fact that most students tend to be sceptic about this technology (Eastman, et. al., 2011). In an interview which involved interviewing teachers, Fuller (2011) had some important findings regarding the weaknesses of clickers. One of the weaknesses defined is that some learners tend to lose interest in the learning tools with time. Further, some teachers thought that few of the lower level learners tend to be intimidated by this technology. Fuller's (2011) study also established that this technology was lacking information retention. The problem is that clickers do not help learners retain information for a long time, as they only work on short attention span. They are not effective to increase outcomes of mid and end of term exams. This

problem is mitigated by clickers being good memory enhancement tools (Shapiro and Gordon, 2012; Dean, 2013).

The above reviewed literature concludes that the integration of clicker technology into the learning process has had positive impacts. Based on the finding of the research, clickers improve learning in a number of ways. For example, clickers improve participation of students, enhance student instruction by educators, and so forth. Such benefits have seen more and more teachers adopt this technology for better learning outcomes. To achieve the anticipated outcomes, educators must ensure that they stick to a number of required best practices; failure to apply these practices, the learning tools may prove worthless. For instance, one of the best practices in the use of clickers is the alignment of these learning tools with the learning goals and objectives. Proper use of clicker will guarantee positive learning outcomes. However, it is important to understand that these tools have their weakness. Understanding these weaknesses will help achieve better learning outcomes. The above literature review also revealed that clickers are suitable for interactive teaching and learning in classroom environment, however, they do not replace traditional, at-home revision and study.

### 3. Purpose of The Study

The above results of the literature review indicate that clickers or QRS (Quick Response Systems) have been used widely in classrooms for several functions. However, some of the findings indicate that there are some downsides associated with their use. Most studies used clickers which were dedicated hardware clickers. Some other researchers used software and web-based ones. However, little research yet explored the use of smartphones as clickers. A Smart-phone can serve as a clicker by using an application or via the web. With the widespread utilization of smartphones among students and educators nowadays, it is evident not only that they can be used in the classroom easily (as clickers using applications or websites), but also they might be used to eliminate some of the downsides of clicker use in classroom: most importantly the cost associated with device purchase. Thus, this study aimed to explore students and teachers views on the use of smartphones as clickers.

The main purpose of this project is to explore the use of smartphones, instead of dedicated hardware clickers, as quick response gadgets. Students and teachers opinions were surveyed after the utilization of smartphones to answer questions and do polls in their classrooms.

To determine if the benefits of clickers noted when using traditional gadgets were transferable when using smartphones instead, criteria to explore clicker use were determined to be used in the study. The criteria used for the impact of clickers were extracted from 66 previous studies regarding the same according to Keough (2012). The following research hypotheses were formulated based on the criteria mentioned as the following:

*Hypothesis 1:* High level of satisfaction will be experienced by students who used Smartphone-facilitated clickers.

*Hypothesis 2:* High level of perceived increases in performance will be attributed to the use of Smartphone-facilitated clickers by students.

*Hypothesis 3:* High level of participation will be experienced by students who used Smartphone-facilitated clickers.

*Hypothesis 4:* High level of feedback will be perceived by students who used Smartphone-facilitated clickers.

*Hypothesis 5:* High level of ease of use will be perceived by students who used Smartphone-facilitated clickers.

The study is also designed to explore whether or not smartphone-facilitated-clickers present solutions to clickers known shortcomings, i.e. technical, logistical, and economical related issues.

### 4. Methodology

This is a qualitative design of survey based on students and educators responses. Surveys were administered to students enrolled in a computer technology course in a technical college in Saudi Arabia. Participants consisted of two instructors and 40 students. Participants (instructors and students) were selected based on the criteria that they had no prior experience with clickers. Being technology-oriented students, it was assumed that using a new technology in the class presented no technical challenge to the students. Similarly, the novelty effect of a new technology was essentially non-existent since the students would be using yet other applications on their Smart-phone. Therefore, no pre-assessment of technology bias for or against the clickers was necessary.

Data collection tools included a Likert survey with additional open-ended questions for students combined with follow-up structured interviews of the instructors. A descriptive statistical analysis was done including frequencies, means, and standard deviation to know students impression directions. The open ended questions and the teacher interviews were written to find out the pros and cons of utilizing smartphones as clickers from their perspectives.

#### 4.1. Intervention Design

An instructional intervention was developed that systematically used distinct QRS techniques in the classroom. A



QRS technique consists of a planned instructional purpose combined with an appropriate response type that is feasible using common QRS solutions. For this study, some well-known techniques were selected and provided to the instructors in advance. They could then select different techniques from which they would then build the actual set of QRS they planned for the class sessions. These techniques include:

- i. Anonymous polls of opinion. This is a whole-class survey of a particular issue. These are typically anonymous, but the same techniques can be voted with authentication as a means of voting.
- ii. Checks for Understanding, simple form. These are anonymous and aggregate checks for understanding that an instructor may do periodically in a session.
- iii. Checks for Understanding, complex form. These are more detailed checks that include specific sub-measures of a concept. They can be combined with a participation request and therefore they are tied to a non-anonymous input.
- iv. Quizzes or Surveys, instructor-paced.
- v. Quizzes, Self-Paced. This is an authenticated, self-paced.

The instructors were told to select at least three different techniques from the above and at least two items per technique. The result would be at least six instances during a one hour-long class session during which the QRS was used. Two sessions were conducted, and then the student surveys were administered immediately after the second session. Teacher interviews were carried out after that to know their findings and impressions.

#### 4.2. Survey Instrument Development

Most of the previous studies employed self-report surveys with a Likert-type and open-ended questions to investigate the use of clickers among students and teachers. Whereas other studies used objective measures such as actual grades and instructor records. This study used a slightly modified version of Keough's (2012) set of criteria extracted from studying 66 clicker technology-based studies. The investigated criteria included: actual performance, satisfaction, perceived performance, participation, feedback, and ease of use. Keough's (2012) criteria were measured by actual grades and grouped survey items. The ease of use criterion was measured using an adapted version of ease of use scale by Davis (1989).

The resulting instrument included a 9-statement survey with 5-point Likert scale for each statement item ranging from (1) strongly disagree to (5) strongly agree (with option 3 being neutral or no opinion). All the items of the survey and their criteria are listed in the following table. The summary of the findings is based on the above criteria, determining the perception of learning support provided by smartphones as clickers.

Table 1. Criterion and corresponding survey items used in the survey

Criterion	Survey statement item
Satisfaction	"I would like to see clickers used more widely in my class."
	"I enjoyed using the clickers."
Performance	"Using the clicker improves my understanding of the instruction."
	"Using the clickers helped me do better in this class."
Participation	"I was more likely to respond/participate/engage with the class because of the clickers."
Feedback	"Using the clickers helped highlight and determine concepts/content areas I needed to study more."
Ease of Use	"Learning to operate my Smart-phone as a clicker is easy for me."
	"I find it easy to get my Smart-phone to do what I want it to do when I use it as clicker."
	"It is easy for me to become skillful at using my Smart-phone as clicker next time I will use it again."

#### 4.3. Data Collection

An open access free application by Socrative was used in this study to enable students and teachers to use their smartphones as clickers. The application enabled teachers to upload questions, quizzes, and pools ahead of the class. The software gives a number for each class so students can use their smartphones to log into a specific website and answer the instructors' questions during the class. Both teacher-paced and student-paced methods were used separately. Using the QRS protocol above, the instructor prepared the questions ahead of the class and posted it in QRS site. The instructor then conducted the different QRS techniques during the class session. At the

end of the second class, the students were asked to fill out the survey regarding their experience of using Smartphone-clicker technology.

The consent forms pinpointing the purpose of the study and participant information rights were distributed and signed before the study was concluded. This is important to ensure that the integrity of participants is preserved and data protection guidelines of research are followed.

#### 4.3.1 Interviews

During the research, two teachers were also asked about the use of smartphones as clickers. In an interview with each one of them, they were asked about speed, quality of Integration, their comfort, opinion, any difficulties when they used clickers in the classroom. They also were asked if they recommend any practices to make the experience more beneficial. Most of the interview questions were adopted with some modifications from Fuller (2011). The interviews qualitative data were analyzed and listed in a table for better result extraction.

Some of the specific issues included in the interview were the ones reported in the earlier literature. For example, some logistic issues included the fear of losing clickers, remembering to bring them to the class, having a small or difficult-to-read screen, getting damage or scratches easily, and requiring much time to pass out and collect them during the class.

#### 4.4. Data Analysis

Data were analyzed using descriptive statistics of means and standard deviations. A reliability coefficient analysis (alpha) for the overall test questions was computed to ensure that the survey was sufficiently reliable. Data from class observation and teacher interview questions were also listed in a table for better result extraction.

### 5. Results

The below table summarizes the findings of the survey. While Likert Scale was used to evaluate perception of functionality and usage, the different functions of smartphones as clickers were also measured. The design was also suitable to measure reliability of the survey as self-report and the possible deviations. Midpoint scales were also recorded for comparison reason.

Table 2. Findings of the Survey

Criterion	Item #	Scale Midpoint	criterion mean	criterion SD
Satisfaction (2 items)	1,2	3	4.30	0.82
Perceived increases in performance (2 items)	3,4		3.90	0.84
Participation (1 item)	5		4.10	0.91
Feedback (1 item)	6		3.95	0.89
Ease of Use (3 items)	7,8,9		4.17	0.78
<b>Overall (9 items)</b>	<b>1-9</b>		<b>4.11</b>	<b>0.84</b>

Internal Reliability test Cronbach's  $\alpha = 0.89$

The Cronbach Alpha value computed for the survey ( $\alpha = 0.89$ ) indicated that the survey internal reliability was sufficiently reliable. As shown in table 2, in general, the students thought positively about the use of smartphones as clickers (mean=4.1, SD=0.84). The positive difference between the scale midpoint and the mean of each criterion items meant that the hypothesis for that criterion is supported. This is evident in all five hypotheses stated earlier: Satisfaction (mean=4.3, SD=0.82), Perceived increases in performance (mean=3.9, SD=0.84), Participation (mean=4.1, SD=0.91), Feedback (mean=3.95, SD=0.89), Ease of Use (mean=4.17, SD=0.78).

The above results table clearly shows that teachers were satisfied with the ease of use, participation enhancement features of the tool, as well as all functions related to increasing classroom participation, providing and receiving feedback and performance. It is also important to note that setting the study in a technology college must have influenced the outcomes of the survey. The assumptions that students and lecturers were already familiar with the technology of smartphones and used applications on a day-to-day basis might have impacted the perception regarding the use of smartphones as clickers. Further, the feedback regarding cost-savings resulting in using smartphones instead of hardware-enabled educational technology was noted by the teachers from their side, not from the school side. Teachers had no influence on decisions made by the leadership of the college regarding purchases and educational tool investment.

In their interviews, the teachers indicated that the logistical issues were not present at all. Those issues included fear of losing clickers, remembering to bring them to the class, having a small or difficult-to-read screen, getting damage or scratches easily, and requiring much time to pass out and collect them during the class. The main justification was the fact that the students used their own smartphones instead of dedicated clickers. "There was almost no possibility that one of the previous issues happen to a student when it comes to using his or her own smartphone", one of the teachers stated. Also, the teachers were happy about the fact that the use of smartphones as clickers with free software application helped them use clicker technology in the class, otherwise, they wouldn't afford to buy it neither their school. *We were able to use this technique and increase student involvement with almost no cost at all*" a teacher said.

## 6. Discussion

Teachers' and students' perception of smartphones' use as clickers has revealed several positive aspects. However, the study was not designed to create a comparison between traditional quick response system technology and smartphone use. In addition, it only covered one college, where familiarity with technology and smartphones was already established among teachers and students. The researcher assumed that primary or secondary school education research or a wider scale study would come up with slightly different results.

Further, the fact that no previous experience with the clicker technology was present in the classrooms the study was conducted might have impacted the results. Still, as a summary, the researcher can conclude that the perception of using smartphones as clickers has been positive among students and lecturers as well. The first impressions were promising, however, the participants survey did not have enough time to evaluate all functions of smartphones used as clickers.

Some important statements, regarding the study, however, need to be noted. First of all: the familiarity of students and teachers with technology is likely to influence their perception of smartphones' functionality and impact on learning. Secondly, there is a need for a comparison study to be created that surveys the use of traditional clicker technologies and uses smartphones in a control group to determine the differences in learning outcomes, perception and participation-enabling features. While teachers surveyed had a positive attitude towards clicker technology, older teachers might not be as willing to try smartphones in the classrooms as younger generations.

There was a need to confirm one of the initial statements listed in the literature review, namely that using smartphones as clickers would result in cost-saving in education. Although this was proven to be true in this study based on teacher interviews, the above conclusion needs to be investigated more in order to determine the level of saving for an average school.

While the problems identified by researchers previously (e.g. Keough, 2012) have not been made a subject of the current study, they did not surface. In order to measure whether smartphones are able to eliminate the problematic areas of using clickers, there is a need for (as previously stated) a comparison study or one that is focused on these problems solely.

## 7. Conclusion

All the presumed benefits of using smartphones as clickers have been confirmed by the above study. All five hypotheses were proven by the answers given by educators and participants. The familiarity with the technology has made it easy for participants to take an active part in the classroom work. Further, the learning outcomes were also improved, as well as the overall experience of teachers regarding the tool. While the perceived outcomes were based on self-report and not test results, one of the most important task ahead is to compare learning outcomes in classrooms using smartphones as clickers and no interactive tools, as well as those classes where whiteboards and smart boards are the only tools of interaction.

The beneficial use of smartphones as clickers has been confirmed by this study. Similar results were indicated by Ed Tech. (2012); Frantz (2011); and Yee, and Hargis (2009). The familiarity with the technology makes it easy for participants to take an active part in the classroom. These findings were also confirmed by many other previous researches like Yee and Hargis (2009); Fuller (2011); and Sternberger (2012). Further, the study also concluded that learning outcomes were also improved, as well as the overall experience of learning in classroom. Similar results were found by various researchers like Anderson et al., (2011); Blood and Gulchak (2012); Blood (2010); and Dean (2013).

The researcher also concluded that the perception of using smartphones as clickers has been reported positive among lecturers as a help in teaching. This finding was also presented by the research conducted by Chatham and Davidson (2011). The familiarity of students and teachers with technology could positively influence the perception of smartphones' functionality and impact on learning.

## 8. Limitations and Recommendations

No real data was created to reveal the difference between user perceived value of traditional and Smartphone clickers, therefore, it is possible that long-term use of Smartphone clickers would result in the same problems as traditional quick response systems.

Further, there are legislative and policy issues regarding the use of smartphones in school that would need to be addressed before calling for a widespread trial or introduction of technologies.

As the study did only cover one higher education institution, there is a need for a future, more comprehensive research design that reveals the institutional differences on various locations, school sizes, as well as the level of teaching. It might be worthwhile to conclude further research among students and teachers who have a different technology-familiarity level and attitude.

The researcher, based on the conclusion, would encourage further research and the introduction of pilot schemes, designed to evaluate learning outcomes and costs of introducing the technology. The research should also cover and reveal possible risks associated with learning in the classroom using smartphones as clickers.

Determining the most effective way of using clickers is likely to result in future research and a design of teacher training related to question design, technology, software and best practices. It is likely that the popularity of smartphones as clickers can be growing in the next few years, given that a well-designed pilot scheme and research study is carried out by experts to determine all the aspects, benefits and possible risks that are associated with the new technology.

One of the main recommendations based on the results is that legislators should start looking into the possible policy and educational background of introducing the technology, taking into consideration student and educator rights, anti-discrimination policies and responsibilities related to the method. Without collaboration with education technology experts, testing the new technology is not possible; therefore, there is a need for interaction, feedback and collaborative discussion within the world of education.

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