

THE IMPACT OF “CLICKERS” ON STUDENT ACHIEVEMENT IN SECOND
GRADE MATH CLASS

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A Master’s Project
Submitted in Partial Fulfillment
Of the Requirements for the Degree of
Masters of Science in Education
Curriculum and Instruction in Inclusive Education
Department of Curriculum and Instruction
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Fredonia, New York

May, 2015

THE IMPACT OF THE USE OF CLICKERS

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CERTIFICATION OF PROJECT WORK

We, the undersigned, certify that this project entitled THE IMPACT OF “CLICKERS” ON STUDENT ACHIEVEMENT IN SECOND GRADE MATH CLASS By Fawaz Alrouqi, Candidate for the Degree of Master of Science in Education, Curriculum and Instruction in Inclusive Education, is acceptable in form and content and demonstrates a satisfactory knowledge of the field covered by this project.

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THE IMPACT OF THE USE OF CLICKERS

Abstract

This thesis sought to answer the question: Does using personal response systems, or “clickers”, improve the achievement of second grade students in addition and subtraction facts as measured by their performance on chapter tests? The research was carried out in a school in Makkah, Saudi Arabia, where participants in the study were second grade students and their math teacher. There were two sections of second grade students with a total of 20 student participants, with ten student participants from each section of the class. The technology was introduced and used during instruction centered on addition and subtraction. Students in both sections were given a pre-test and post-test consisting of three questions on subtraction and addition, comprising of single, double and triple digit numbers. The data collection period was during the second half of May 2014. Weekly continuous assessments or diagnostic exercises were also conducted. A survey questionnaire was conducted after the instruction and the use of the clickers in order to examine the students’ experience of using clickers. The responses of the students were collected from the class using the clickers. The test results showed the scores in both classes were similar in post and pre-tests (26 correct answers), compared to 23 and 24 correct answers without the clickers, thus showing a slight advantage with the use of clickers.

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Introduction

With globalization, the means and sources used in the American education system have significantly changed. In the past, classrooms were not as well-equipped with the latest technology as they are today. Technology is always changing, and with the passage of time it has advanced and innovative ideas and equipment have developed, which has become part of classrooms. The emergence of innovative and inexpensive technology has always been a target of mankind (Spector, Merrill, Elen, & Bishop, 2008). The use of advanced technology in the education system not only facilitates students, but it also helps the educators to improve the learning experience. Although using advanced technology has become part of the school education system, it is not a long standing practice (Saettler, 2004). Educational technology, popularly known as Ed Tech is the practical implementation of learning via advanced technology. This technology improves the learning and performance of students with the use of technological processes and resources. Ed Tech is an addition to the education system developed in the 70's for distant learners (Hiltz, 1990). The use of technology in schools can be more simply defined as a set of tools, which become helpful in the advancement of learning skills of students (Caldwell, 2007).

Initially, the technology was introduced in the schools in the form of computers. Later, as information technology moved on, changing the patterns of economic, social and cultural life, it greatly influenced the education sector as well. Today the use of digital tools has become an important part of the education system in the United States of America and students are experiencing continuous and growing exposure to new technologies (Geer & Sweeney, 2012). Personal response systems, commonly known as “clickers” are the best medium to collect the responses of a large scale audience (Caldwell, 2007). This device is basically a classroom

response system. In schools, clickers allow the instructors to ask questions of students and immediately record their responses. The use of clickers allows the faculty to record accurate data on students' responses towards any question posed. Clickers are helpful for teachers as they enable them to gauge students' understandings based on the immediate feedback from the device (Zhu, 2007).

The use of personal response system, or clickers, facilitates the active engagement of students in primary schools. The clickers provide data based on immediate responses from students. They ensure the participation of each and every student in the class and create a safe space for participation of unsure students as well. Clickers help teachers to convey their lecture in a way that adapts to the basic learning needs of the students. The use of clickers will help the teachers to know basically what the students need to learn. For example, if the student responses indicate they have understood the lecture perfectly, then the teacher might shift to the next topic. Clickers would change the scheme, flow, and pace of teachers' lectures because all these features will be influenced by the response of the students to the topic their teacher is teaching. The lecture should not proceed unless the students grasp the concept and give correct answers to the questions asked at the end. Hence, the collected responses from clickers help teachers get more student engagement on important issues (Kyei-Blankso, 2009). Like every digital innovation, the use of clickers also has some drawbacks. A question has been raised as to whether the use of clickers improves student achievement. In the United States, almost every educational institution ranging from schools to universities is integrating advanced technology into their learning systems in order to support the learning process. Also in Europe, according to the Parliamentary Assembly stats, E-learning has a big role in influencing the process of education and training development (Fischer, Papadopoulos, & Ayva, 2008). Apart from the use of technology in

schools, it has become necessary to have a thorough understanding about the technological know-how of the underlying mechanism and its related consequences on student learning performance. Clickers are being used in classrooms to determine whether students understand the fundamental concepts or not, because getting the right answer is less important than identifying the knowledge gap or misconception (Keller, Finkelstein, Perkins, Pollock, Turpen, & Dubson, 2007).

At the university level, use of clickers by the faculty across all disciplines enables them to keep their students motivated and actively engaged in the class activities including lectures, presentations and quizzes. Despite the fact that they are particularly designed for large lecture classes, they are equally beneficial for smaller classes. Some faculty members use clickers in small group discussions in their large lecture classes (Blasco-Arcas, Buil, Hernández-Ortega, & Sese, 2013). The use of clickers is highly appreciated in schools and other educational institutions. Keller (2007), a researcher on the use of clickers in the classroom, described his first experience using clickers at the Physics Education Research Conference in 2007, he said clickers helped him to maintain student attention and concentration towards the lecture. The use of the personal response system allows him to respond to questions about any presented assignment.

My first experience using a clicker was an interesting incident in my life. Displaying the question on the overhead projector, my professor told the class that we had 90 seconds to answer the question. He gave us prior instructions about the use of clickers for giving final responses. According to him, “think before you click”. This sentence gave me an alarming sense of consciousness and concern about the correct use of the clicker. I carefully read the multiple-choice questions and carefully selected my final answer by pressing the response button on my clicker. Other students also gave their responses and a tally was displayed on the projector

screen. It was a unique experience for me. It was my first introduction to the clickers. My personal experience reveals that the use of technology in the education system greatly enhances the level of interactivity with the teacher. As a student, the use of clickers helped me to improve my learning ability and performance simultaneously. Use of clickers in the elementary school can be beneficial beyond expectations (Caldwell, 2007).

Introduction of clickers in the logical subjects, like math, will result in sharpening the mental math of students at an early age. While studying in the United States, I experienced the use of the latest and advanced techniques and technology in the education system. I appreciate the use of clickers and other technology to enhance the active engagement of students in class activities. With globalization, the education pattern worldwide has been drastically changed. The more technologically advanced nations, like the United States, have put all the latest technology in use to better facilitate their students, but there are many other countries, which are not using technology in the education system to make it more effective (Mishra, 2014). In my own home country, Kingdom of Saudi Arabia, there is a need to update the education system. Although the government has taken good steps to maintain the system, still there is need to change the traditional infrastructure of the education system in Saudi Arabia. For this reason, I have chosen to investigate the impact of the use of clickers on the math achievement of second grade students as measured by their performance on chapter tests in Saudi Arabia.

Literature Review

The literature review of the use of clickers in education proved that it is a comprehensive field of study. Many researchers consider it to be one of the effective learning classroom technologies and for future researchers there is a lot to study about clickers. A lot of research has been done regarding the use of clickers or Class Response Systems (CRS) and about their

effectiveness in class, but there is no general consensus about the use of clickers. Different researchers have different opinions about clickers and their role in classes. Here, I will discuss how clickers dominate the environment in class and how they shape the mood and pace of the class.

Theoretical Framework

With the change in civilization and the modernization of culture, teaching and learning processes have also gone under transformation. It was not so long ago when classrooms were teacher centered, and the teacher used to be the focus of the whole class with all the activities centered on him. Now the time has changed and classrooms have become student-centered. Student-centered learning is an approach in which much of the content, pace, scheme and the activities are dominated and decided by the students. In this pattern the teachers can assist the learners to grasp the concepts, independent of one another and by giving them exercises that can activate their individual cognitive skills (Froyd & Simpson, 2008).

Student-centered learning is now also implemented in elementary schools. Previously, this approach was used in advanced classes where students were able to handle this. Technologies like overhead projectors and multimedia are now commonly used in elementary classes. These technologies are used to make the learning process more attractive, easier and more effective. New technological advancements encourage and attract the students to take an interest in learning and results in increased learning. When diagrams and charts were replaced by the use of multimedia, then it became easier and simpler for students to see more accurate figures and diagrams and grasp the concepts presented. Along with the technology assisting in the learning process, new technology is also developed that helps to keep track of the performance of

the students and monitor their progress on a daily basis. The student learning approach has helped the teachers to assist their students in a manner that no student is left behind.

The advent of science has not only introduced new fields of study, but also transformed study and studying processes. The teaching and learning process started with writing in the sand and now it has reached the point where classrooms are equipped with electronic equipment and gadgets that have made learning and the learning process easier. Clickers or the Classroom Response System (CRS) is another technology that provides help to teachers and students to ensure learning goals. Along with advanced classes, clickers are now also encouraged in elementary classes. The main goal of clickers is to get the response of students about a topic taught recently, and the percentage of the correct responses to the questions determines whether the teacher has to repeat the instruction or move forward. Since clickers provide an immediate response classroom technology, they are favored and have been applied in a number of schools and colleges.

Similar to developed countries, clickers, is a classroom technology that is used in major universities in Saudi Arabia. Advanced level students use this technology to improve their performance in class by increasing the percentage of people who succeed in learning new concepts and can successfully apply what they learn. Clickers have facilitated a lot of colleges and universities in improving the learning standard and in increasing the number of students who succeed.

Some people are against the use of clickers in schools, because, they believe that younger students are not equipped, mentally or emotionally to use this technology. They believe that it may be a toy for them, which they may play with, and this can affect the pace and effectiveness of teaching. Students in elementary or even primary sections may not take it seriously because

for these students this technology may be like a remote control that helps them to take charge of the proceedings of the class. This argument can be considered correct due to the level of thinking and the seriousness of the children at this time of life, but, multiple solutions can be presented using this technology effectively.

This paper deals with the role of clickers in increasing the learning process in elementary school. This research is intended to find out the answer to the question whether the use of clickers improves student achievement in math. Since clickers are used for multiple-choice questions, and the result of the class' average is shown in the bar chart, the teacher can observe the performance of a class on the basis of that chart. As, the clickers technology is very easy to use, this research involved both the teacher and the students of the class to observe the complete impact of the use of clickers in the class. The research also focused on finding out the productivity of the class session, after the use of clickers, in terms of learning and time efficiency.

Considering the use of clickers in the elementary school experiment, specifically second grade students, this research will focus on mathematic classes. Clickers assist the teacher to access the students' learning level and give enough time for the teacher to conduct practice sessions. Rigorous practice can not only ensure better understanding, but, can improve areas in which some students are lacking. In this experiment, the purpose was to test the use of clickers on second grade mathematics classes doing tests on addition and subtraction questions.

Definition

Bruff (2009) describes clickers as the pedagogical technology that permits the teacher to scrutinize and interpret the responses received from the questions quickly during the lecture. To record the responses of the audience, the device utilizes the infrared technology to note the

responses of students to the questions. The author of this research, considered the clickers as an educational technology, which makes it easier for the lecturer during the class to gather the information from the students and to analyze this data in the fastest way (Simelane, & Skhosana, 2012). The manufacturing of the modern clickers is different from the original ones. The modern clicker basically has 10-digits on its keypad and other necessary buttons essential for usage, such as the sending button, a power switch button and a function key that allows the entry of texts (Caldwell, 2007).

Clickers are a technology used to strengthen the learning of an individual. Upon discussing the advantages of clickers, most researchers assume that the students enjoy and are engaged in using this device. When comparing the advantages of Clickers with the traditional methods of lectures, clickers are more enjoyable and engaging for the students. Students find it easy to interact during the lecture (Duggan, Palmer, & Devitt, 2007). Both traditional methods and clickers consist of active learning, but the learning outcomes associated with the use of the clickers are more extended and quick as compared to the other active learning activities (Martyn, 2007).

Description

The main description of the clicker system is an interactive system, which is widely used for the students in classrooms, as well as in the audience poll systems and the voting systems to generate a response. According to Simpson and Oliver (2007) the name of the clickers is different in different countries. For example, in the United States, personal response systems are commonly known as the keypads and clickers while in the United Kingdom they are known as zappers and handsets. This advanced classroom technology works in two ways. On one hand, it can send the signals to the receiving point and on the other hand, it can also receive information

summarizing the students' responses (Bruff, n.d.). In this way students can develop a link between the information and their own learning style or cognition (Tremblay, 2010). In the past, clickers were not wireless because they were connected to the computer system with wiring and used infrared and radio frequency signals. The most commonly used signals are the infrared signals because they require one receiver, and are not interrupted by lights in the classroom and have a stronger signal (Caldwell, 2007).

It can be seen that once the main response of each student is recorded in the clicker, through choosing one right option, the record goes into the main computer via the radio frequency waves, and the results are then displayed by the instructor in the form of a graph, or a chart indicating what each student has answered. This instills healthy competition within the students as well as gives them a chance to interact in the classroom, thus improving their skills through active class participation as examined by Katz (1999). To make class lectures less passive and impersonal, most of the institutions are using this technology in the hope of increasing the focus rate, particularly in the sciences (Burnstein & Lederman, 2011).

Use

Clickers are fairly simple to use, and it can be seen that even second grade students can easily use them. Though they might seem difficult to use at first, the fact is that even these small children can easily select the options, which are available on the clicker, and use these to make a desired choice. In this way students can interact with the teacher in a more active and effective way (Draper, Cargill, & Cutts, 2002). Not only does this encourage them to give the right answers, but it also allows them to make use of technology from a very early age and in an effective way. For example, the shape, size and style of the Clickers are almost same as that of the remote for a T.V or phones (Bruff, 2009).

Basically, the main mechanism is simple. The teacher poses a desired question and the students make use of these questions and their clickers to make a selection of their choice. The options are given through the projector on a screen, and the students can choose either a, b, c or d, depending upon what they take to be the right answers. When students have the choices to choose a certain response the results of such interaction can be measured in numbers (Fies, Marshall, 2008). The teacher gives the students enough time to answer the right question, and the repeated and reviewed gives them confidence of doing the calculations in the right manner, and then indicating what they take to be the right answer as stated by Mollborn and Hoekstra (2010). In order to evaluate the class understanding of a complex and comprehensive lecture, the instructor uses the clickers to create an informative learning environment by polling the students to determine their understanding. With the common software program such as PowerPoint, Acrobat and Word, the response is being collected and integrated in the clicker software. The grades and responses of the students get transferred to a data file such as Microsoft Word or Excel, and then can be imported into the Blackboard course management system. The data in the form of bars, percentages, pie charts, etc. are displayed on the screen and then can be discussed in the class among all the students and the instructor (UC SanDiego, 2014).

Advantages and disadvantages

Advantages. As with every piece of technology, there are certain advantages as well as disadvantages associated with the use of clickers as a device in the second grade classrooms for math lessons. The fact is that while these devices seem to be very simple and engage the students at a second grade level, there are certain disadvantages as well, or certain complications, which the students might get themselves into while using clickers. As far as the main advantages are concerned, the fact is that the use of clickers in the second grade classrooms, actually advance

the main lessons of math, and help in advancing the students to calculate simple addition and subtraction problems of the second grade level (Zhu, 2007).

It can be expected that the clickers can also be used to enhance the overall learning or help the minds of the students to grasp the lessons of math. There are various advantages of using the clickers in classroom lectures. First is to identify the misconceptions about a specific subject before presenting the knowledge to students about it. For example, a common misperception a student might have can be tested and the student answers would help the teacher realize misconceptions. By giving the choices of responses, the teacher can get the idea what students think about a certain subject, hence, he or she can eradicate any false perception and guide them in a right direction (Carnaghan & Webb, 2006).

Secondly, using clickers can help the faculty to quickly check the level of the student's knowledge. Thirdly, clickers make it easier for the faculty to note the students' understanding of the content of the lecture more easily than the normal lecture without the use of clickers. To get immediate results after the use of the clicker makes it easier for the teacher to judge how much the students have understood of the lecture; hence, the instructor can decide whether there is a need to present more instruction or to review previously presented material in whole or part.

By observing the responses of their peers in the classroom, the students can clearly understand how well they are doing in comparison with their fellow students and how much time they have to devote to review the specific topic. Another advantage of the use of clicker technology in the classroom is that it makes it easy to gather unidentified feedback from the students on the faculty's teaching by asking questions to the students related to the discussion in the classroom, group activities, lecture and the comprehensive learning experience (Zhu, 2007).

Lastly, with the help of clickers one can record the attendance and the participation of the students. It is a feasible and a convenient way to take the attendance in a massive lecture such as at the start of the lecture. The responses of the students with the clickers serve to record student attendance. The teachers at the end of the class can find quickly from the results who was absent or present in the class lecture, which helps the teachers save time for the lesson (Zhu, 2007). Despite all the advantages, there are certain disadvantages of the use of clickers.

Disadvantages. Although the clicker is a very useful device, a few negative things about clickers have been reported. Firstly, is the cost of the clicker. All students have to have their own clicker device for polling; hence, some students find it to be an expensive device to use. Also, there has not been much empirical research done on the real time positive effect of using such technology to warrant a huge installation investment (Boser, 2013). There is more concern about the costs encountered by students when students do not perceive the device to be valuable. Secondly, during the class lectures, teachers and students can encounter technical difficulties with the use of clickers (Zhu, 2007). Another disadvantage of using the clickers during the lectures is that it can distract the students from the topic under discussion and the continuity of the lecture can be disrupted (Richtel, 2010).

Furthermore, a study from the University of Michigan showed that students do not like the very primitive use of the clickers that only note student answers and record participation. Also the ecological effects of technology should be taken under consideration (Postman, 1993). Inconsistent use of clickers and the absence of teachers' feedback on the responses of the students after a clicker question were also considered negative aspects (Zhu, 2007). Clickers are mainly used in colleges and universities and its effectiveness is noticeable, however, this technology can be used in schools also and specifically in elementary schools.

The engagement

There are many education experts who consider clickers as an entertainment toy of electronics for students (Conoley, Moore, Croom, & Flowers, 2006). The engagement of students increases with the use of clickers as they become more engaged in the entertaining activity of class participation through the use of clickers. Students start liking to come into the class with more interest and pay more attention to the class. In this way their attendance also improves (Bullock, LaBella, Clingan, Ding, Stewart, & Thibado, 2002). The use of clickers could be one tool to engage the students in the classroom, but it does not mean that it is the only thing through which students can be engaged. Teachers should find out and formulate strategies to establish engaging activities for students apart from clickers, so that they can enjoy the classroom and can participate both with and without clickers (Rhem, 2007). This means that merely one technology cannot fulfill the learning requirements of all students. There are many studies, which show that the students with low performance do not find clickers to be an engaging tool in the class (Addison, Wright, & Milner, 2009). This technology is only helpful when the teachers supplement it with effective teaching methods and techniques. With good instruction, clickers can be very effective in engaging students and enhancing their learning experience (Addison, Wright, & Milner, 2009). In this research I observed the class, which used clickers, was more enthusiastic than the one that did not. There would be more effective results if teachers started using this technology coupled with their effective teaching techniques.

A study by Ke, Sun, Yang, and Sun (2012) focused on finding the relation between usefulness of technology, ease of functioning, user friendly equipment and the attitude of users towards technology. Initially nine hypotheses were derived in the studied, later research told that when the student is better engaged and has interest in the class, then it becomes easier for a

teacher to present new ideas and concepts and easier for students to grasp these. Therefore, when class response systems are used, they increase the attractiveness, interest and engagement of students in class, resulting in a good learning outcomes for that session (Ke et al., 2012).

Morgan (2008) studied the importance of interest and attentiveness of the student in class and how this can be increased with new teaching methods like clickers. In her research a few teachers and ten sections of the students (four of psychology, two of accounting, two of education and two of speech) participated in the research and on average, 150 students participated in both clickers and traditional classes. The questions asked using the clickers for responses were formative and evaluative and not detailed questions. The results showed that clickers do help in increasing the interest of students in the class and help them to increase their efficiency and performance using this gadget, as it allows them and helps them to give their answers freely and without hesitation. The students become engaged in class when they use clickers and this fact is irrespective of the age or grade of student.

Use of Clickers in Elementary Schools

Modern education is becoming challenging and it is becoming more and more difficult for the teachers to impart knowledge to the students. For this reason, several pedagogical technologies have been introduced that not only assist the teacher, but also, help the students to get interested in class and grasp the concept a better way. The clicker technology has been used in elementary schools also and has shown its effectiveness. After being used in 5th grade, in English class it has been observed that the clickers help to increase the vocabulary, improve understanding of the grammar and develop comprehension skills. The research also showed that in urban elementary schools, clickers proved to be a useful and powerful tool in the classrooms (Moratelli & DeJarnette, 2014).

Helms (2004) performed an experiment on students of the elementary school in rural areas, about the use of clickers. Twenty-nine students from two sections of the first grade participated and the multiple-choice questions were asked of the class using clickers. After the pre and post-tests were conducted and the data were analyzed completely, it was revealed that clickers assisted the students in responding quickly and taking an interest during the whole session of the class.

The use of clickers helps teachers and students to bring innovation in the class and to change the environment of the class. It is believed and observed that the teachers who use modern technology get better results in their classes because this technology helps them to increase the performance of the class. Moreover, with the increase in use of clickers and the increase in frequency of use, the performance of the class becomes better and the individual students can show their understanding in the class (Penuel, Boscardin, Masyn, & Crawford, 2007). In elementary schools the classes are of several grades and a lot of studies have been done on the use of clickers in the second grade.

Second Grade

Second grade expectations. A typical second grade looks like a place, which is full of creativity and creative young minds of the children, who are trying to flourish and have great expectations. The typical second grade classroom has a lot of artwork on display, and has important visual displays as well as the rules and regulations of the class, which are exhibited in a very colorful manner. Generally, reminders like the addition and subtraction rules and the class rules are displayed in the form of a poster or chart, with drawings, which attract the students. Also, in second grade most students practice the skills learned in kindergarten and first grade and begin to utilize these independently. Regarding language and literacy, most students in second

grade can read and write at an introductory level. They can handle more and more texts in and out of the classroom as they work to become fluent and accurate readers.

Teaching math to children in second grade becomes more complex. There are no specific math standards in Saudi Arabia, but the rules followed in math are similar to the rules followed in the USA (“Grade-by-Grade Learning,” n.d.). Children are taught how to add and subtract two and three digit numbers, and they are also given some knowledge about multiplication and division. At this level, children have to apply the concepts taught in first grade, such as skip counting and practice skills to gain command of them. At second grade, kids are able to group numbers, count, order and work with numbers at a faster pace than they can physically count (“Grade-by-Grade Learning,” n.d.).

The main expectation of the second grade students is that they develop a basic understanding of math, science and language, which enhances their learning as well as gives them an opportunity to explore more details. It can be seen that the main expectations of students are that they are able to understand the teacher. Additionally, the teacher should deliver the lessons in an engaging way, which grasps their attention. Moreover, it can also be seen that the teachers have certain expectations for second grade students as well. The teachers expect that by this grade the students are able to understand the teacher’s direct instruction, and they are able to read on their own, and understand the basic routines. More so, they also expect these students to actively participate in class, and ask any queries they have. They expect the students to listen to them carefully and have the basic understanding of the alphabet, reading, writing, as well as math skills of addition and subtraction (Bruff, 2009).

Though the gap between the first and second grade students is not much, children in the second grade show more academic and social skills; hence, the parents of the child expect the

child to become more independent and mature at this level. As some basic skills are carried from the previous class, the instructor does not need to work as hard to get the students used to the routine of the school. Consequently, the expectations of the teachers for the second grader in the school is much higher than that of the first grader, and as a result, there are additional responsibilities in class for a student in second grade (Ghezzi, 2009). Differences in views of people occur in the use of clickers, but, most of the people believe that it helps to engage students in class.

Math Facts

The importance of math facts. Math is a very important as well as a basic subject. It can be seen that math is used as a daily application in everyday life and a basic understanding is required of every student. Math facts are primarily used to provide the students with an understanding of the common rules of math, and how operations like addition and subtraction can take place at the very basic level in second grade. These math facts are important for the students to learn so that their basic understanding of the subject flourishes and they can use the subject at a more practical level as stated by Simelane & Skhosana (2012). Mathematics is a subject of order and pattern, which gives human life a certain pattern and gives orderly answers to many myths about the universe (Devlin, 1994). These facts are important for the students to learn and practice in order to excel in math and in their future academics in general. Furthermore, it can also be seen that math is a very student friendly subject, which means that the more interesting the teachers make it for the second grade students, the easier it will be for the students to understand (Mura, 1993). The math facts and the rules such as addition rules, subtraction rules, and the use of interactive technology can make math a more interesting subject for the students.

The best practice in developing fluency. Developing fluency in math is very important and this comes with increased practice. Performing even basic functions like addition and subtraction becomes easier with increased practice. The more the students are involved in the practice of the subject, the greater their fluency becomes of the subject. Also, teachers have to be actively involved in the practice sessions with the second grade students (The Alliance Education, 2006). According to Battista (1999), mathematics is considered to be a form of reasoning. Mathematical thinking includes reasoning in a logical way; developing understanding; examining conjectures; building an understanding of something; and making and clarifying judgments, presumptions and conclusions. In addition to the above, it can also be seen that this fluency can come from the increased interaction of the students as well. The teachers need to encourage the active participation of the students and involve them daily in mental exercises as well as written exercises, instead of just spending time in delivering direct instruction only. In this way, these young students will enjoy the learning experience as well as become more fluent in their skills of addition and subtraction. This fluency is very important to develop within this age bracket, because once the basics are strong at this level, then they will be able to develop better mathematical skills (Mollborn & Hoeskstra, 2010).

The Relation Between Math And The Use Of Clickers

It can be seen that there is a very important relationship between teaching math as a subject and using the device of clickers to teach this subject to the second grade math students. Like in other subjects as well as in audience poll stations, the clickers can be used in the subject of math for the second grade students in order to enhance their learning skills as well as develop their interaction powers. The use of clickers for teaching math will ensure that the students get well enough in practice sessions and do not continually practice incorrect procedures, thus

reinforcing their mistakes (Cline et al., 2012). During planning out a lesson of math, if a teacher includes a lot of practice exercises, then this act can compel the student to lose interest in class and the students may start ignoring the teacher. When the clickers are used in the class, they can assist in increasing practice sessions in math questions. However, teachers should keep in mind that if there is an excessive amount of practice, then again the student can lose interest in class and may start pressing the button randomly, so there should be a limit on questions asked (Nelson, n.d.). Clickers help to get the immediate response of the students and in this way the teacher immediately knows which area is creating problems. Then the teacher can focus on that specific area so that the mistakes may not be done in the future and ensure that students do not repeat the same mistake again and again. The need to answer questions correctly and quickly is very important in mathematics, and clickers have proven to increase speed and accuracy and the overall performance of students (Strasser, 2010).

In addition to the above stated advantages, clickers also allow teachers to assess exactly in which part, whether addition or subtraction the students are weak. This is judged based on the answers, which will be provided by the students, and the class polls, which will result. Moreover, the teachers can also use these clickers in order to ensure that daily quizzes are taken in class and the results are returned on the spot to the students. Thus, the use of clickers can be ideal for the class of second grade math students, because it can allow for greater fluency practice, active participation and increased knowledge for the students as well as the teachers about which areas of math need additional work.

Methodology

Setting

The data collection period of my study started on May 12, 2014 and ended on May 22, 2014. The participants in this study were second grade students and one of the teachers of the Makkah's School (MS). MS was built in 2002 in Makkah, Saudi Arabia. The research was done in one of the best private schools in Makkah, Saudi Arabia. This school has a very good reputation because it is equipped with the best scientific methods like smart boards, whiteboards and projectors. This school was selected for the research because this school has not used clickers before.

Since it is a private school, it is registered by the government of Saudi Arabia, but runs under a private administration. Some private schools opened in Saudi Arabia are for people of a specific nationality, like British, Pakistani, American and Indian Schools. Makkah's school is located in Makkah, Saudi Arabia, which is the most important city from a religious point of view of Muslims. It is a city that remains busy all through the year and the school is located in the area which is relatively less busy. Due to the calm and silent environment, the teachers at the school get a better chance to instruct their students. The school uses Arabic as the medium of instruction and students have to pass the test planned by the schools in order to move up from grade 2. The school has facilities to assist the students in learning in diverse ways. After completing an education in this school, students move on to join middle and secondary schools. The tuition fee at this school is 10,000 Saudi Rayals, about 2,660 US dollars per annum. It is an elementary school and the age of children are seven to twelve. There are 400 students and 30 teachers in the school. All of students and teachers are boys and there are 4 sections of second grade classrooms with approximately 13 students in each second grade class.

Participants

The total number of participants was 20 students from two classes and one teacher. The first requirement was that the participants should be specifically the students of the second-grade. The participants were between the ages of eight to nine years old. I chose to work with this grade level because it is easy for the students to understand the questions being asked. There were ten second grade students in each section; hence the total number of students were 20. The teacher who was teaching the classes was about 43 years of age and had 12 years experience. He taught eight years in Egypt and four in Saudi Arabia. Currently, he is the employee of Makkah's School and has taught second grade for the last three years.

Design

The research design is quantitative. The reason that it is a quantitative research is that I collected pre and post test score data. The main purpose of my research was to investigate the effectiveness of using clickers in the math classroom and the effect on the learning experience of the second grade math students. I did this by analyzing the students' results on the class assessments.

In the beginning I explained to the teacher how to use the clickers because he did not have any experience with them. The main aim of the teacher was to teach the students about math and about how to use the clickers while delivering math class lectures.

The teacher completed two surveys: survey A (see appendix A) at the beginning of the study and survey B (see appendix B) at the end of the study. In survey A, the teacher shared his teaching experience, effectiveness, and expectations. The second survey B was about his perception after using the clickers in the classroom.

The study was based on two classes of the second grade students; the teacher in the first class used the clickers in his math classroom where the topic was subtraction and addition approximately for two weeks. While the other classroom practiced subtraction and addition without the use of clickers. The subjects, topics and teacher were all the same in both classes.

The students in both classes took the pre-test and post-test of the questions related to math such as the subtraction and addition of two and three digit numbers and were graded. Also, the students' response data was collected from the class using the clickers. The results were analyzed to see whether there was a difference in student learning achievement between the students who used the clickers and the students who did not.

Data Collection

Data collection was done from the pre-test and post-test (see appendix) for all the students in both second grade classes. In survey A, the teacher shared his experience about the clickers. The questionnaire prepared by the researcher was filled out by the teacher. There were basically two surveys, survey A at the beginning and survey B at the end. The survey A had six questions related to the experience of the teacher regarding the use of clickers. In survey B, there were again six direct questions related to the teacher's opinions about the use of clickers.

Two tests were conducted, pre-test and post-test. In the pre-test, there were two questions on addition and one question on subtraction of two digit numbers. In the post-test, the number of questions remained the same while the focus of the questions was switched. Specifically, there were two questions on subtraction and one question on the addition of two digits.

Also, there were ten exercises (see appendices E-N) which had the same questions asked of the second grade students in both the section that used the clickers and the section that did not.

The students who did not use the clickers responded by using paper and pencil while the clicker class responded to questions displayed on the whiteboard. For example, the teacher wrote the question on the white board and instructed the students to answer it with the use of clickers. For the students using the clickers, the responses of all the students were collected on the software, which was connected to the computer and the data was then analyzed.

Data analysis

The data analysis is the process in the research after the data is collected from the participants. The answers of the all the 20 students from the two classes were collected. The classroom technology of clickers was connected with software, which was already installed in the computer. All the data of the students after the pre-test and post-tests were collected and prepared for analysis. The analysis of the data was done in a way to compare the answers of both the classes.

There were ten exercises and two tests completed over ten days for the two sections of second grade students, one using the clickers and one without the clickers. Both sections had to answer the same questions and an exercise was given on day one, exercise 2 on day two and similarly the other exercises were completed within ten days. All the exercises had the same pattern of questions, including one subtraction and one addition question. After all the exercises were completed at the end of day 10, the solved exercises were reviewed and the answers were checked. After all the answers were checked, the percentage of the results of each correct and wrong answer was calculated. After the percentage was calculated for each section, the comparison of those results was done to check the performance of the students who were using clickers. After this comparison was done, later on the basis of percentage results, it was checked in which type of questions, students using clickers faced the problems.

The results were compared between the students who had answered the questions of addition and subtraction in ten days with the clickers and those who were asked the same questions without the clickers. Later, the results were analyzed with the help of the pre-installed software on the computer. Different tests were conducted to analyze the data and to inspect the hypotheses.

While conducting the whole process of exercises, it was made sure that the students were learning, and the learning ability and the effect of the use of clickers on their performance were judged. Pre-test and post-test were conducted to compare the performance of the students after they are done with the exercises, using clickers and how these exercises reflect on their post-test.

If we analyze the test results of the pre and post-test, we will observe that the students' performance of the students with clickers was far better than those in students without clickers. In the pre-test, the students with clickers gave three more correct answers than the students with clickers. It shows that instead of taking it non-seriously or having any pressure they were using it easily and performed better than their counterparts. When we look at the results of the post-test, the performance of the students with clickers was better, and they gave two more correct answers than the one without clickers. If we compare the overall performance of pre-test and post-test, we will observe that the performance of the students with clickers remained same, before and after post-test. That means the clickers and the practice session did not have any effect either positive or negative impact on the performance of the students. Whereas, the performance of the students without clickers improved, slightly, after the practice sessions, but, their performance was not overall better than the students with clickers.

Limitations

In this research there are two limitations. The first limitation is that there was a small number of participants. If there were larger numbers of classes, then a larger amount of data would be collected. As a result, the collected data could have been analyzed in a better and more expanded way; hence, the result would have been more informative and accurate.

Another limitation emerged because of the lack of experience of the teacher about how to use clickers. Therefore, at the time of data collection it was difficult for the teacher to help the students on how to use the clickers and later on how to analyze the answers collected on the software. There were approximately 30 teachers in MS. This was another limitation faced in the study of the research because none of them had experience using the clickers.

Findings

The experiment consisted of both surveys and tests. The survey comprised of the questions regarding the use of clickers was completed by the teacher. Tests were divided into two groups depending on the use with or without clickers. The number of students in all tests remained the same, thus, to create homogeneity. Moreover, while conducting the test, a lot of importance was given to the fact that during whole tests (pre and post-tests), the one who attempted the first question of the test was also instructed to attempt all the questions by himself, so that the true results were achieved. The findings of these surveys and tests are given below.

Surveys

The first questionnaire focused on the teacher's opinion on the possible use of clickers in class before they were actually used. The second questionnaire was the response of the teachers to the use of clickers after he had used them with one class.

Survey A. It was reported that the teacher has teaching experience of twelve years of which, eight years were in Egypt and four in Saudi Arabia. The total number of years being spent with second grade was three years. The teacher believed that new technology should surely be used in classrooms because it can not only help the teachers, but also, the students in the class and will help them perform well. He also believed that clickers could help in increasing the interest of students in the lectures and would encourage them to get involved and participate in the class. The teacher was familiar with the use of a projector in the class and had used it quite often, but this was the only technology he had regularly used in the classroom.

Survey B. The teacher responded that he would definitely prefer to use clickers in class in the future because he believed that it is a modern method of teaching and assists the teacher to increase the involvement of students in the class. Clickers can prove to be helpful in class because they can raise the interest of the students in the class and the students can respond positively to the questions posed. The teacher said that instead of making a guess about students' understanding, he had the real response with the help of clickers. For example, instead of conducting a few exercises and deducing the results, the teacher could conduct multiple exercises and observe the true response of the students immediately.

Tests and Exercises

Two main tests along with ten exercises were conducted in this experiment. In the first class section of the study, the students used the clickers to take the tests and complete the exercises while the second group of classes used the traditional method of pencil and paper to solve the exercises and tests. There were two types of tests, (pre and post-test).

Pre-test. This test was conducted in both classes, one test used clickers and the other traditional methods on the first day of the study. A total of twenty students took this test from the

two sections of classes. The test consisted of three questions using single, double, and triple digit addition and subtraction. (see appendices C and D)

Pre-test with clickers. On the first question on two-digit subtraction, given to ten students, eight gave the correct answer. The second question was of addition of number 706 and 152. Out of ten students, eight gave the correct answer. The last question was of addition and the students had to add three squares and one other square. All ten gave the correct answer. (see Appendix C for details.)

Pre-test without clickers. From the class that was not using clickers, ten students participated in the test. Out of ten students answering the first question, eight gave the correct answer. For the second question, out of ten students, seven gave the correct answer. On the last question all ten students gave the correct answer. (see Appendix D)

Post-test. This test was conducted in both classes, i.e. one using clickers and one using traditional methods of the last day of the study. A total of twenty students took this test, ten from each section or class. (see Appendices E and F)

Post-test with clickers. There were three questions and the first question was about subtraction and was the subtraction of number 43 from 88. All ten students of the clickers section, gave the correct answer. The second question was of addition and was addition of number 142 and 232. Out of ten students, six gave the correct answer. The last question was of addition and the students had to add two squares in two other squares. Out of ten students, nine gave the correct answer. (see appendix E).

Post-test without clickers. There were three questions and the first question was about subtraction and was the subtraction of number 43 from 88. Eight gave the correct answer. The second question was in addition and was an addition of number 142 and 232. The correct answer

to this question was 374. Six gave the correct answer. The last question was of addition and the students had to add two squares to two other squares. All the students gave the correct answer.

(see appendix F).

Comparison of pre-test and post-test. Here the Table 1 is given, which shows the comparison between pre-test and post-test and also between students with clickers and without clickers.

Table 1

Comparison of Pre-test and Post-test for Both Classes

Elements	The number of students	Total number of responses	Total number of correct responses
Pre-test with clickers	10	30	26
Pre-test without clickers	10	30	23
Post-test with clickers	10	30	26
Post-test without clickers	10	30	24

When we analyze this table, we can see that in pre and post-tests the performance of the students with clickers was better than the students without clickers. From a comparison of the results of the pre and post-test it is evident that the class that used clickers achieved better scores. They recorded 26 correct responses on both the pre-test and post-test. Whereas, the class which was not using clickers, had 23 correct responses on the pre-test and 24 on post-test. These results, which are reflected in the table, favor the clickers and indicate that they be an effective tool in math classroom.

Exercises

There were ten exercises, which consisted of two questions, over a ten day period for both groups. One question was of two digit addition and the other one was two digit subtraction. A total of 20 students participated in these exercises, ten from each class, and ten students had clickers and ten were without clickers.

Table 2

Results of Students in Ten Exercises

Exercise #	Questions	Correct answer	The Correct answer of the students with clickers	The Correct answer of students without clickers	Change in performance of students with and clickers
Exercise 1	35 - 12	23	10	7	+30%
	35 + 12	47	7	7	0%
Exercise 2	52 - 10	42	7	10	-30%
	48 + 31	79	8	9	-10%
Exercise 3	35 - 12	23	9	7	+20%
	32 + 56	88	6	8	-20%
Exercise 4	89 - 51	38	7	7	0%
	47 + 32	79	10	8	+20%
Exercise 5	16 - 13	03	7	8	-10%
	48 + 51	99	7	9	-20%
Exercise 6	94 - 13	81	8	9	-10%
	45 + 41	86	9	10	-10%
Exercise 7	79 - 23	56	7	8	-10%
	13 + 45	58	10	9	+10%
Exercise 8	23 - 07	21	5	8	-30%
	56 + 23	79	7	9	-20%
Exercise 9	84 - 60	26	5	9	-40%
	78 + 22	99	7	9	-20%
Exercise 10	49 - 33	16	9	9	0%
	37 + 22	59	6	9	-30%

From this table, it is evident that the total of twenty questions were attempted in ten exercises, two questions in each exercise. Among these twenty questions, a considerable difference can be seen between students with clickers and without clickers. In thirteen of twenty questions, the results of the students without clickers remained far better than the students with clickers and in only four questions, the result of the students with clickers remained better. It is opposite to the result from pre and post-test. The difference might be due to the fact that the students were new to technology and were taking time in adjusting to it.

Discussion

This study aimed to determine the effectiveness of the use of Classroom Response Systems or clickers in the math class of an elementary school. The experiment comprised of two surveys, questionnaires from the teacher and ten exercises. In addition, a pre-test and a post-test were given to a total of twenty students, ten from each class. Below is an analysis of the exercises and tests results. I examine the data gathered in detail and discuss the cause and effects of what actually happened.

Analysis of Views of the Teacher

Analysis of Survey A. Modern technology is being used in all the fields of life. When the teacher was asked about the use of technology in survey A, he was of the opinion that it would be good to use new technology in classrooms. In spite of having twelve years of teaching experience, the most recent technology the teacher has used in the class was a projector. Even so, the teacher realized that new technology and its introduction into the class is important. Regarding clickers, the teacher had the expectation that this technology would help to increase the involvement of students in the class. As the teacher was associated with second grade students for three years and was well aware of the psychology of that age group, he was

confident his students would benefit from the technology and their performance levels would increase.

Analysis of Survey B. This survey was conducted after instruction and testing with the use of clickers. The overall response of the teacher in survey B was positive. Again, the teacher realized the importance of new technology in education; therefore, in spite of the difficulties faced in the use of clickers, the teacher still insisted that clickers should be used in class. Also, because the teacher was aware of the playful habits of this age group, he believed the gadgets would assist in increasing student interest and involvement in class. Moreover, the teacher noticed that when his students indulged in crosstalk and mischief, the clickers helped to bring their interest back to the lecture. The response of the teacher also shows that he is aware of the importance of clickers in class and realizes that it will help in reducing the waste of time. When using traditional methods of learning, the teacher had to go one by one to check the test of every student, which required a lot of time. Hence, the clickers do make the grading for the teacher more efficient, saving him valuable time to be used for additional activities. Realizing all these benefits, the teacher favored the use of the Class Response System or clickers.

Comparison of Tests

According to Table 1, 20 students were pre-tested and post-tested. Among the 20, ten used the clickers and ten did not. Both tests consisted of 3 questions each. The ten that used the clickers recorded 26 correct answers on both tests. Whereas, the ten who did not use them only answered 23 correct on the pre-test and 24 on post-test.

Though it was a very small difference between the groups, the scores favored the clickers. This indicated the use of clickers can bring positive change in the results no matter how

small it may be. For one thing, it certainly appears that the use of clickers is not impacting the results negatively.

Comparison of Classes in terms of Exercises

A total of ten exercises were conducted, in the practice of adding and subtracting concepts. Each exercise had one question of subtraction and one of addition. Both exercises involved two digit numbers. The following is an analysis of the performance on the basis of concepts of subtraction and addition.

On basis of addition questions. In ten exercises, ten questions in addition were asked and all addition questions were with two-digit numbers. Table three lists the performances of students with clickers and without clickers. The performance of the students can be judged and compared by using this information. The data here presents the result of the students on the basis of two questions in each test.

Table 3

Comparison of Results in Addition Questions

Results of Addition Questions		
Exercises	Result with clickers	Result without clickers
Exercise 1	70%	70%
Exercise 2	80%	90%
Exercise 3	60%	80%
Exercise 4	100%	80%
Exercise 5	70%	90%
Exercise 6	90%	100%
Exercise 7	100%	90%

Exercise 8	70%	90%
Exercise 9	70%	90%
Exercise 10	70%	90%

An analysis of the above results (Table 3) shows that out of ten questions, there was one question (Exercise 1) where both groups got identical results (70%). Also, the test revealed that the non-clickers did better on seven out of ten exercises. So, in the questions of addition the performance of the class not using clickers remained far better than the one using clickers. There can be a number of issues involved here. While doing the exercises, the students were getting used to new equipment and it might have caused them to hurry and give wrong answers in their excitement. Even an adult person needs time to get used to new things and may make mistakes because of nervousness. Similarly, it is the case with children, usually children are super excited when using something new, and with being overly excited and getting used to a new gadget, this may have factored in the results.

On basis of subtraction questions. In ten exercises, ten questions of subtraction were asked and all subtraction questions were of two digit numbers. The performance of the students using clickers and not using clickers is given in the table below. Also, the performance of the students in each exercise is given in percentages and comparison is done using the data from Table 4.

Table 4
Comparison of Results in Subtraction Questions

Results of Subtraction Questions		
Exercises	Result with clickers	Result without clickers
Exercise 1	100%	70%
Exercise 2	70%	100%
Exercise 3	90%	70%
Exercise 4	70%	70%
Exercise 5	70%	80%
Exercise 6	80%	90%
Exercise 7	70%	80%
Exercise 8	50%	80%
Exercise 9	50%	90%
Exercise 10	90%	90%

Analysis of the above detailed results reveal that out of ten questions, there were two questions where both groups scored the same (Exercises 4 and 10). Also, the test revealed the non-clickers did better on six out of ten questions. Again, the test showed the students without the clickers did far better than the clickers.

In critically analyzing these exercises, it is important to point out that the students using the clickers did worse when the digit zero was part of the equation, as was the case in exercises eight and nine. This makes me wonder whether they may have misinterpreted the digit zero and answered the questions incorrectly. Also, their second worst was exercise two where the digit zero was also part of the equation. Apparently, what we can derive from the data available to us is that the clickers are not as effective as the traditional method. Due to some unknown reasons

the students with clickers are finding it difficult to solve questions with the number zero. The analysis of the bar charts might show the reason behind this phenomenon.

Analysis of Bar Charts

What is evident from the exercises, is that the performance of students with clickers remained far better in addition than in subtraction. Bar charts are shown as the result of clicking options from the three available. The bar charts tell about the percentage of students who selected a certain option to a question. As there were three options in each question, therefore, three bars were made for each question. Here analysis can be made by looking at the bar and analyzing the answers selected. All the options studied will focus on incorrect choices.

In exercise 2, the first question was the subtraction of number 10 from 52 and the available options for the question were: 42, 24 and 44. The correct answer was 42, but, only seven students selected option 42, two selected 24 and one selected 44. Whereas, in the addition question, number 48 was to be added to 31 and the available options were 79, 97 and 77. Eight students selected option 79, one selected 97 and no one selected 77. In exercise 4, the first question was the subtraction of number 51 of 89 and the available options for the question were 38, 83 and 88. The correct answer was 38, but, seven students selected option 38 and the rest of the three selected 83. In exercise 6, the first question was the subtraction of number 13 from 94 and the available options for the question were 81, 18 and 11. The correct answer was 81, but, only eight students selected option 81, one selected 18 and the last one selected 11. Whereas, in the addition question, there was an addition of number 45 and 41 and the available options were 86, 68 and 66. Nine students selected option 86 and one selected 68. In exercise 7, the first question was the subtraction of number 23 from 79 and the available options for the question were 56, 65 and 55. The correct answer was 56, but, seven students selected option 56, two opted

for 65 and one student selected 55. Similarly, in exercise 8, there was the subtraction of number 7 of 28 and the options available were 12, 21 and 11, where 50% each selected options 21 and 12. In addition, of 56 and 23, seven students selected option 79, one selected 97 and two selected 77.

With all the questions and their answers presented here, there was similarity in the options available. Two options were mirror images of one another and the third option consisted of double figures and one of the numbers was part of the real answers. For example, in exercise 8, in the addition question the available answers were 79, 97 and 77, showing a mirror effect.

The apparent general result of the answers showed that clickers are not effective in elementary school math class, but after analyzing the above-mentioned information critically, it is apparent that the user of the clicker might get confused while giving answers. It is a common error that the children calculating one result will choose and submit another result that closely resembles their calculation when using the clickers. In other words, they may mistakenly choose 97 instead of 79. The bar chart showed there was a pattern for children to have a tendency to select such options.

After analyzing these answers and the pattern in them, it appears to be a fair chance that students have calculated the answer correctly, but, while giving the answer pressed the wrong button. So, it is a confident claim that clickers are not the possible cause of bad performance of the students, it is the common error done in most computational work in mathematics.

Role of Bar Charts in Helping Teachers

As it has been discussed, in this experiment the tests and exercises comprised of multiple choice questions (MCQ). These MCQs gave three options, thus, three bar charts were available at the end of each question. When the students gave answers, the bar chart not only helped the

teacher to get the percentage of the students who gave the right answer, but also, the chart allowed him to see the wrong selections, and to see a percentage on what options were chosen the most. With the help of these charts, the teacher could analyze the reason behind the choices of the wrong answers, which would help the teacher pinpoint the confusion among students and determine the best way to correct the issue.

Bar charts helped the teacher to save time in classes because they helped in checking the answers of all students. Also, it helped the teacher pinpoint problem areas because he could see where their mistakes were and get the general trend of the class. The use of bar charts is an accurate, time saving gauge, which allows the teacher to concentrate and move on to more activities that will help students.

Analysis of Role of Clickers in Elementary School

The literature review presented the study of Bullock et al. in which it was said that the use of clickers in elementary classes increases the attendance of the students and the children loved to use it because it reminded them of a toy (Bullock et al., 2002). The research tells us that the teachers who use clickers or other Class Response Systems more frequently in class are expected to receive better results later. The improved instructional level and the better response of the students, using clickers, depend on how frequently these devices are used (Penuel, Boscardin, Masyn, & Crawford, 2007). In this experiment, teachers and students were using clickers for the first time, that is why they faced difficulties and the teacher himself admitted it, but also preferred to use this technology in the future. The teacher was of the view that the difficulties faced by both the teacher and students and the level of response of the students were limited by the use of the instrument for the first time.

It is not difficult for children to use clickers because it is the most simple and common device and assists the students in every regard. The instruction given to the elementary students to use clickers were same as the ones given to higher classes. Clickers also guarantee full participation of the student. According to the response of the teacher, the maximum number of students did take an interest in the work, because of the clickers. This might not only be due to the attraction of new technology, but also, because the students were not afraid of getting the question wrong. In addition, the shy students also participated and took interest in solving the problems and giving their results by clickers. Even in elementary school the students remained interested in the class due to clickers.

Analysis of Role of Clickers in Math Class

Clickers are used in many fields and also in educational institutions. In educational institutions, in all the subjects including mathematics, clickers are preferred. When clickers are used in math class in elementary school, they can help to increase the learning ability of the students and also enhance the interaction between the teacher and students. Earlier it has been discussed that the use of clickers helps the students and teachers to increase the practice sessions and also it shows whether the students are doing the questions correctly, and are not repeating the same mistakes (Cline et al., 2012). When the clickers were used in the class, ten exercises were done to increase the understanding of the students in the concepts of addition and subtraction. Since the teacher continuously used the bar charts to analyze the performance of the class, the teacher could make sure the students were getting help with the challenging questions. In this experiment, as discussed earlier, students had problems in subtraction questions and specifically with the numbers that involved the digit zero. All this information helped the teacher

to analyze the situation and to repeat exercises and practice on those questions in order to get rid of the problems the students were having.

In contrast, Nelson (n.d.) believed that the excessive math practice with clickers may result in students losing interest in class. When the results of this study were analyzed, many incorrect options chosen seemed to be random. It appeared that either the student was not paying attention or selected the mirror number incorrectly. So, this research may support Nelson's point that excessive use of clickers may also compel the student to lose interest in the lecture.

Role of External Factors

External factors also might have affected the performance of the student in the class. Initially, clickers were a new technology for both teacher and students. Some of the mistakes made in the practice sessions might have occurred due to the inexperience of the users with the gadget. This inexperience has resulted in a number of incorrect answers, and it could be that with more practice and experience students would get much better results using clickers.

Secondly, the elementary school students usually have distracted behavior and initially they might have taken this gadget as a toy and played with it. When students get used to the technology then they will start understanding the importance of it, resulting in the increase in effectiveness of this technology. Also, the continuous use of this technology will help the student to better understand the way in which it is used and learn the ways in which it could help them and the teacher.

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Appendices

Appendix A**Survey A****(The Teacher: before the use of clickers)**

- 1- How many years have you taught?**
 - **12 years (8 years in Egypt and 4 years in Saudi Arabia).**

- 2- Have you ever used educational technology in the classroom before?**
 - **Yes, I have used the projector.**

- 3- Have you used the clickers before?**
 - **No.**

- 4- How many years have you taught the second grade?**
 - **3 years.**

- 5- Do you prefer to use technology in the classroom?**
 - **Sure, because it is useful for the students and the teachers.**

- 6- Do you expect the use of clickers will affect the students' understanding?**
 - **Sure, it makes all the students involved in the lesson.**

Appendix B**Survey B**

(The Teacher: after the use of clickers)

- 1- Did you have any problem with using the clickers in the classroom?**
 - I did have few problems because it was my first time I use it.

- 2- Did the students participate in both classrooms?**
 - Yes, all the students participate.

- 3- Do you prefer to use the clickers in the future? Why?**
 - Yes, because it is a modern method of teaching and makes all the students involved in the lesson.

- 4- Does the students' participation differ between both classes? Why?**
 - Yes, it is different because the device insures all students are paying attention to the teacher.

- 5- Do you think the use of clickers in the classroom is helpful for the students? Why?**
 - Sure, because it positive for the students and the students cannot be ignored in the lesson.

- 6- Do you think the use of clickers in the classroom is helpful for the teachers? Why?**
 - Yes, it will help the teachers because it shows the teacher the real students' answers.

Appendix C

Table A

Pre-test with Clickers

The question	The number of students	The number of the correct answers	The percentage of the correct answers									
<p>1)</p> $\begin{array}{r} 53 \\ - 12 \\ \hline \end{array}$ <p>A) 12 B) 14 C) 41</p>	10	8	80 %									
<p>2)</p> <table border="1" style="margin-left: 20px;"> <tr> <td style="background-color: #ffffcc;">H</td> <td style="background-color: #add8e6;">T</td> <td style="background-color: #ffffcc;">O</td> </tr> <tr> <td>7</td> <td>0</td> <td>6</td> </tr> <tr> <td>1</td> <td>5</td> <td>2</td> </tr> </table> <p>+ </p> <p>A) 858 B) 825 C) 808</p>	H	T	O	7	0	6	1	5	2	10	8	80 %
H	T	O										
7	0	6										
1	5	2										
<p>3)</p> <p> + =</p> <p>A) 5 B) 4 C) 2</p>	10	10	100 %									

Appendix D

Table B

Pre-test without Clickers

The question	The number of students	The number of the correct answers	The percentage of the correct answers									
<p>1)</p> $\begin{array}{r} 53 \\ - 12 \\ \hline \end{array}$ <p>A) 12 B) 14 C) 41</p>	10	8	80 %									
<p>2)</p> <table border="1" style="margin-left: 20px;"> <tr> <td style="background-color: #ffffcc;">H</td> <td style="background-color: #add8e6;">T</td> <td style="background-color: #ffffcc;">O</td> </tr> <tr> <td>7</td> <td>0</td> <td>6</td> </tr> <tr> <td>1</td> <td>5</td> <td>2</td> </tr> </table> <p>+ </p> <p>A) 858 B) 825 C) 808</p>	H	T	O	7	0	6	1	5	2	10	7	70 %
H	T	O										
7	0	6										
1	5	2										
<p>3)</p> <p> + =</p> <p>A) 5 B) 4 C) 2</p>	10	10	100 %									

Appendix E

Table C

Post-test with Clickers

The question	The number of students	The number of the correct answers	The percentage of the correct answers									
<p>1)</p> $\begin{array}{r} 88 \\ -43 \\ \hline \end{array}$ <p>A) 45 B) 44 C) 43</p>	<p>10</p>	<p>10</p>	<p>100 %</p>									
<p>2)</p> <table border="1" style="margin-left: 20px;"> <tr> <td style="background-color: #ffffcc;">H</td> <td style="background-color: #ccffff;">T</td> <td style="background-color: #ffffcc;">O</td> </tr> <tr> <td>1</td> <td>4</td> <td>2</td> </tr> <tr> <td>2</td> <td>3</td> <td>2</td> </tr> </table> <p>+ </p> <p>A) 232 B) 374 C) 473</p>	H	T	O	1	4	2	2	3	2	<p>10</p>	<p>6</p>	<p>60 %</p>
H	T	O										
1	4	2										
2	3	2										
<p>3)</p> <p> + =</p> <p>A) 5 B) 4 C) 2</p>	<p>10</p>	<p>9</p>	<p>90 %</p>									

Appendix F

Table D

Post-test without Clickers

The question	The number of students	The number of the correct answers	The percentage of the correct answers															
<p>1)</p> $\begin{array}{r} 88 \\ - 43 \\ \hline \end{array}$ <p>A) 45 B) 44 C) 43</p>	<p>10</p>	<p>8</p>	<p>80 %</p>															
<p>2)</p> <table border="1" style="margin-left: 20px;"> <tr> <td style="background-color: #ffffcc;">H</td> <td style="background-color: #ffffcc;">T</td> <td style="background-color: #ffffcc;">O</td> </tr> <tr> <td>1</td> <td>4</td> <td>2</td> </tr> <tr> <td>2</td> <td>3</td> <td>2</td> </tr> <tr> <td colspan="3" style="text-align: center;">+</td> </tr> <tr> <td style="background-color: #e0f0ff;"></td> <td style="background-color: #e0f0ff;"></td> <td style="background-color: #e0f0ff;"></td> </tr> </table> <p>A) 232 B) 374 C) 473</p>	H	T	O	1	4	2	2	3	2	+						<p>10</p>	<p>6</p>	<p>60 %</p>
H	T	O																
1	4	2																
2	3	2																
+																		
<p>3)</p> <p> + =</p> <p>A) 5 B) 4 C) 2</p>	<p>10</p>	<p>10</p>	<p>100 %</p>															

Appendix G

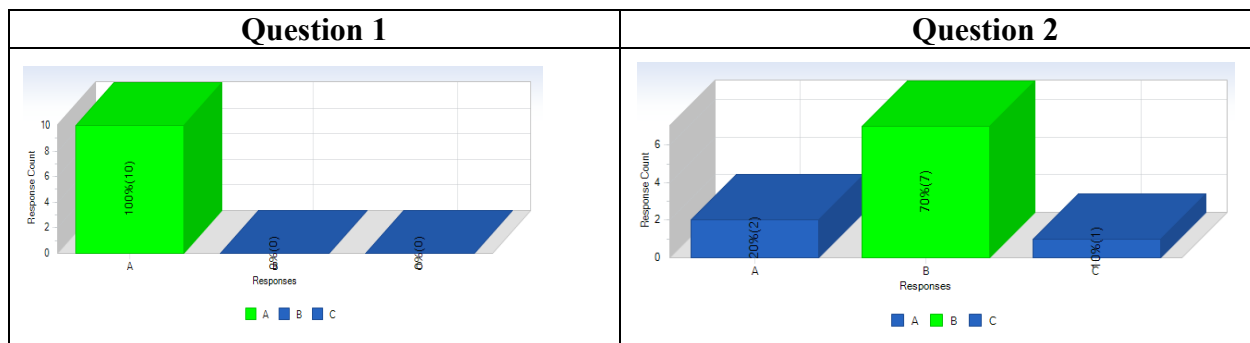
Table E

The Exercise Number 1

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
1) $\begin{array}{r} 3 \quad 5 \\ - \quad 1 \quad 2 \\ \hline \end{array}$ A) 23 B) 32 C) 22	Without Clickers	10	7	70 %	Percentages different
	With Clickers	10	10	100 %	+30%
2) $\begin{array}{r} 3 \quad 5 \\ + \quad 1 \quad 2 \\ \hline \end{array}$ A) 33 B) 47 C) 34	Without Clickers	10	7	70 %	Percentages different
	With Clickers	10	7	70 %	0%

Table F

The Students Respond with Clickers Exercise Number 1



Appendix H

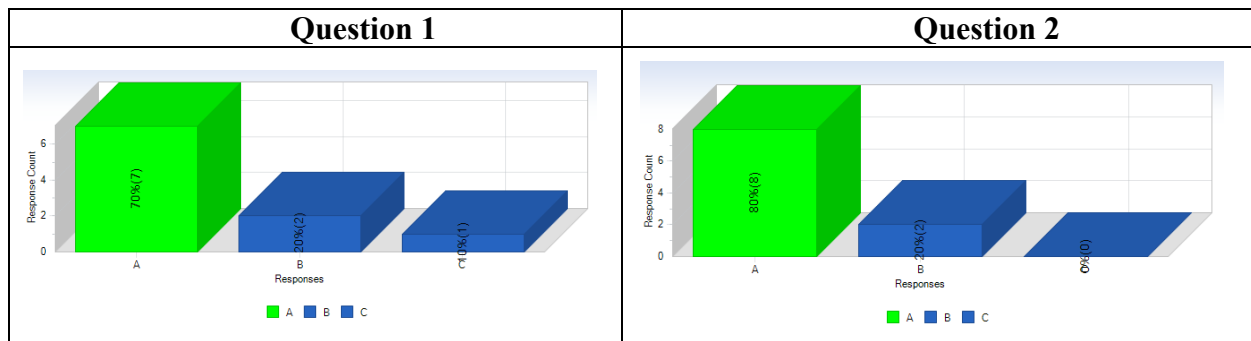
Table G

The Exercise Number 2

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
1) $\begin{array}{r} 52 \\ -10 \\ \hline \end{array}$ A) 42 B) 24 C) 44	Without Clickers	10	10	100 %	Percentages different
	With Clickers	10	7	70 %	-30%
2) $\begin{array}{r} 48 \\ +31 \\ \hline \end{array}$ A) 79 B) 97 C) 77	Without Clickers	10	9	90 %	Percentages different
	With Clickers	10	8	80 %	-10%

Table H

The Students Respond with Clickers Exercise Number 2



Appendix I

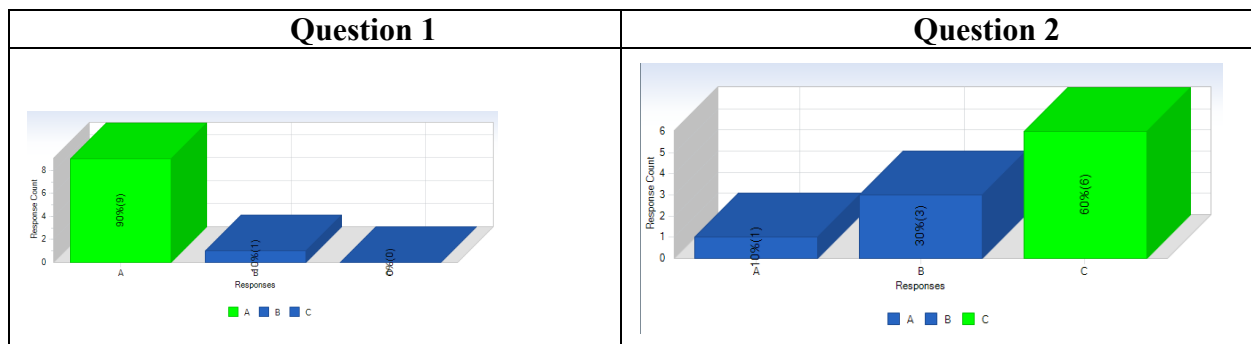
Table I

The Exercise Number 3

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
$\begin{array}{r} 3 \quad 5 \\ 1) - 1 \quad 2 \\ \hline \end{array}$ <p>A) 23 B) 50 C) 32</p>	Without Clickers	10	7	70 %	Percentages different
	With Clickers	10	9	90 %	+20%
$\begin{array}{r} 3 \quad 2 \\ 2) + 5 \quad 6 \\ \hline \end{array}$ <p>A) 83 B) 87 C) 88</p>	Without Clickers	10	8	80 %	Percentages Different
	With Clickers	10	6	60 %	-20%

Table J

The Students Respond with Clickers Exercise Number 3



Appendix J

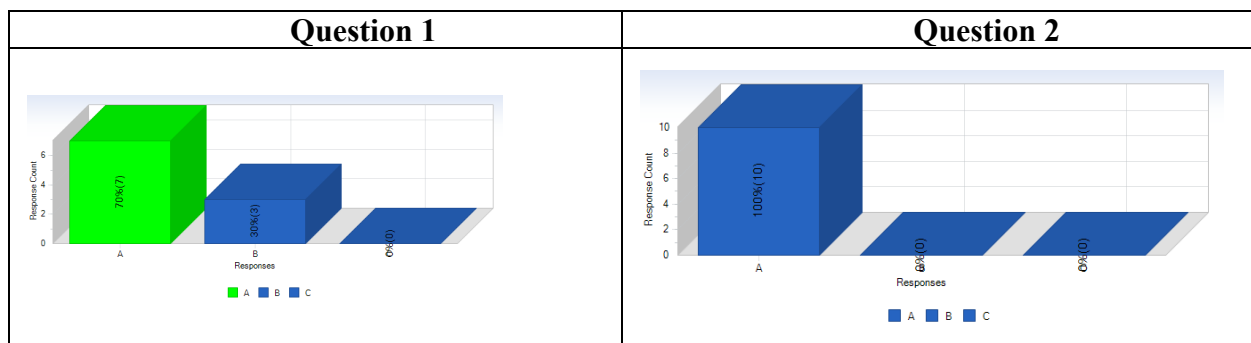
Table K

The Exercise Number 4

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
$\begin{array}{r} 8 \quad 9 \\ 1) \quad - \quad 5 \quad 1 \\ \hline \end{array}$ <p>A) 38 B) 83 C) 88</p>	Without Clickers	10	7	70 %	Percentages different
	With Clickers	10	7	70 %	0%
$\begin{array}{r} 3 \quad 2 \\ 2) \quad + \quad 4 \quad 7 \\ \hline \end{array}$ <p>A) 79 B) 77 C) 99</p>	Without Clickers	10	8	80 %	Percentages Different
	With Clickers	10	10	100 %	+20%

Table L

The Students Respond with Clickers Exercise Number 4



Appendix K

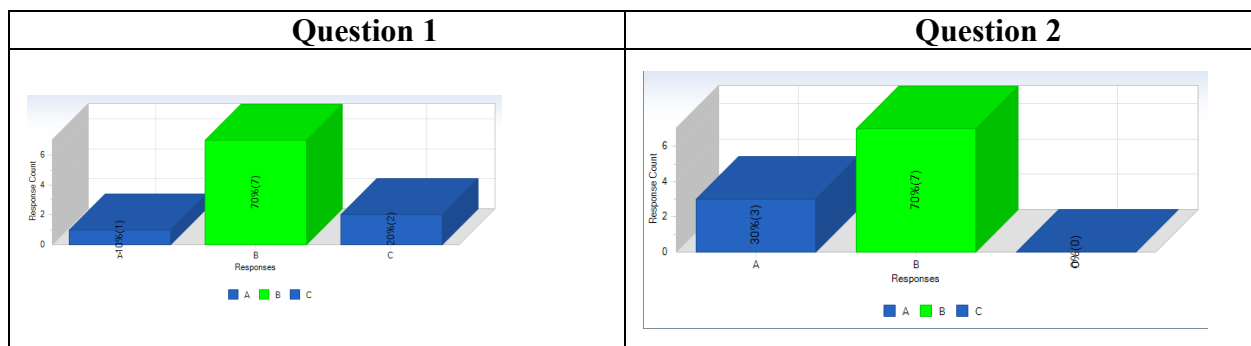
Table M

The Exercise Number 5

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
$\begin{array}{r} 1 \quad 6 \\ 1) \quad - \quad 1 \quad 3 \\ \hline \end{array}$ <p>A) 33 B) 3 C) 12</p>	Without Clickers	10	8	80 %	Percentages Different
	With Clickers	10	7	70 %	-10%
$\begin{array}{r} 5 \quad 1 \\ 2) \quad + \quad 4 \quad 8 \\ \hline \end{array}$ <p>A) 98 B) 99 C) 89</p>	Without Clickers	10	9	90 %	Percentages Different
	With Clickers	10	7	70 %	-20%

Table N

The Students Respond with Clickers Exercise Number 5



Appendix L

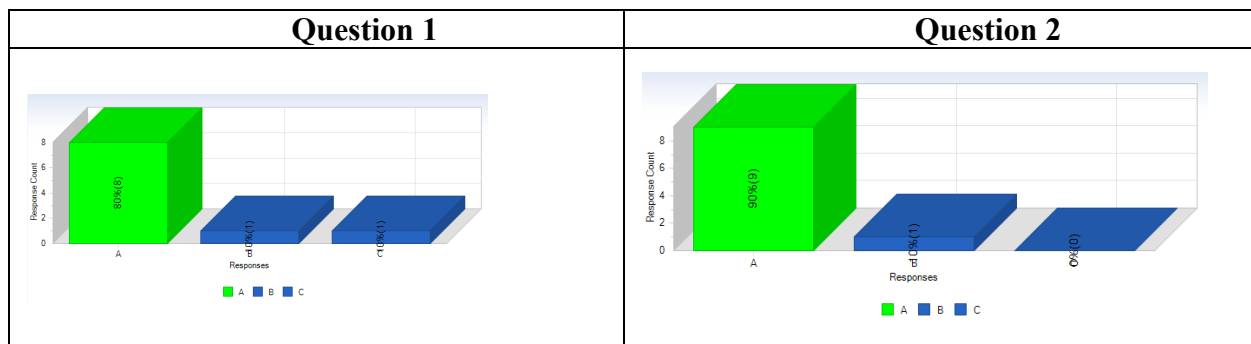
Table O

The Exercise Number 6

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
$\begin{array}{r} 9 \quad 4 \\ 1) \quad - \quad 1 \quad 3 \\ \hline \end{array}$ <p>A) 81 B) 18 C) 11</p>	Without Clickers	10	9	90 %	Percentages different
	With Clickers	10	8	80 %	-10%
$\begin{array}{r} 4 \quad 5 \\ 2) \quad + \quad 4 \quad 1 \\ \hline \end{array}$ <p>A) 86 B) 68 C) 66</p>	Without Clickers	10	10	100 %	Percentages different
	With Clickers	10	9	90 %	-10%

Table P

The Students Respond with Clickers Exercise Number 6



Appendix M

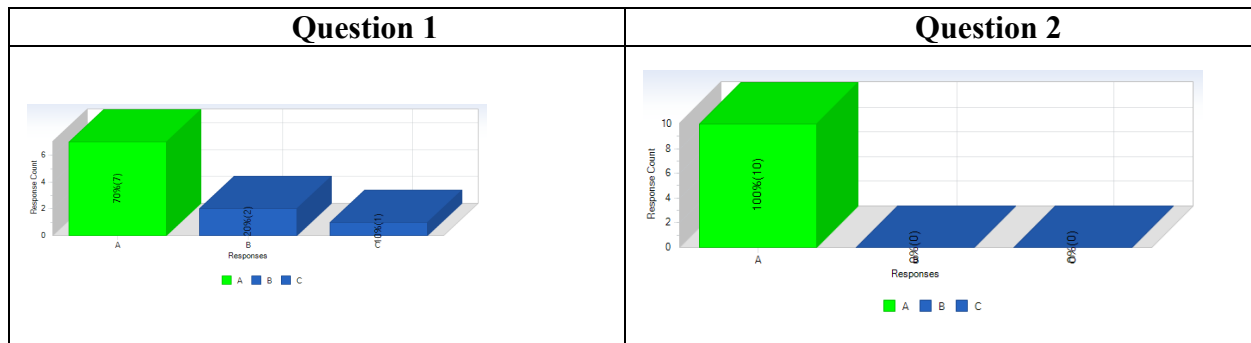
Table Q

The Exercise Number 7

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
$\begin{array}{r} 7 \quad 9 \\ 1) - \quad 2 \quad 3 \\ \hline \end{array}$ <p>A) 56 B) 65 C) 55</p>	Without Clickers	10	8	80 %	Percentages different
	With Clickers	10	7	70 %	-10%
$\begin{array}{r} 1 \quad 3 \\ 2) + \quad 4 \quad 5 \\ \hline \end{array}$ <p>A) 58 B) 85 C) 55</p>	Without Clickers	10	9	90 %	Percentages Different
	With Clickers	10	10	100 %	+10%

Table R

The Students Respond with Clickers Exercise Number 7



Appendix N

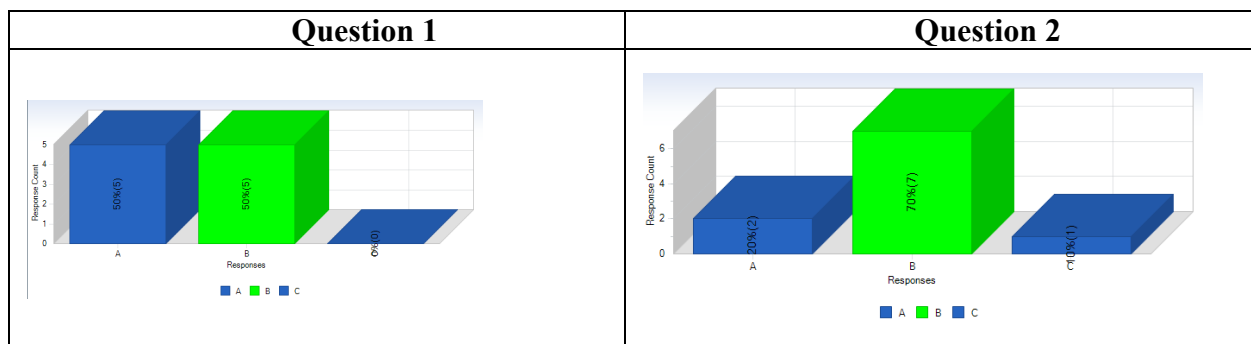
Table S

The Exercise Number 8

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
1) $\begin{array}{r} 28 \\ - 07 \\ \hline \end{array}$ A) 12 B) 21 C) 11	Without Clickers	10	8	80 %	Percentages different
	With Clickers	10	5	50 %	-30%
2) $\begin{array}{r} 56 \\ + 23 \\ \hline \end{array}$ A) 77 B) 79 C) 97	Without Clickers	10	9	90 %	Percentages Different
	With Clickers	10	7	70 %	-20%

Table T

The Students Respond with Clickers Exercise Number 8



Appendix O

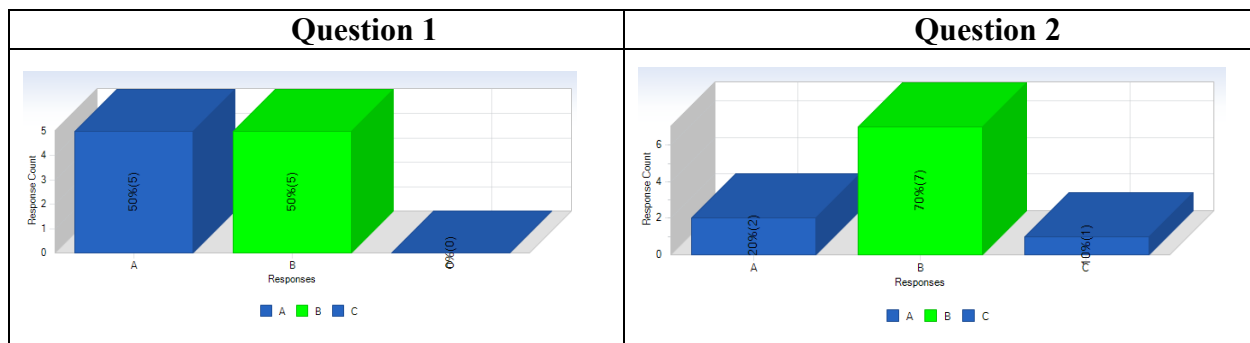
Table U

The Exercise Number 9

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
1) $\begin{array}{r} 8 \quad 4 \\ - 6 \quad 0 \\ \hline \end{array}$ A) 20 B) 24 C) 22	Without Clickers	10	9	90 %	Percentages different
	With Clickers	10	5	50 %	-40%
2) $\begin{array}{r} 7 \quad 8 \\ + 2 \quad 1 \\ \hline \end{array}$ A) 98 B) 99 C) 89	Without Clickers	10	9	90 %	Percentages Different
	With Clickers	10	7	70 %	-20%

Table V

The Students Respond with Clickers Exercise Number 9



Appendix P

Table W

The Exercise Number 10

The question		The number of students	The number of the correct answers	The percentage of the correct answers	
$\begin{array}{r} 4 \quad 9 \\ - \quad 3 \quad 3 \\ \hline \end{array}$ <p>1) A) 17 B) 16 C) 61</p>	Without Clickers	10	9	90 %	Percentages Different
	With Clickers	10	9	90 %	-10%
$\begin{array}{r} 3 \quad 7 \\ + \quad 2 \quad 2 \\ \hline \end{array}$ <p>2) A) 32 B) 55 C) 59</p>	Without Clickers	10	9	90 %	Percentages Different
	With Clickers	10	6	60 %	-30%

Table X

The Students Respond with Clickers Exercise Number 10

