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**THE EFFECTIVENESS OF STUDENT RESPONSE SYSTEMS IN TESTING
FOR STUDENTS WITH LEARNING DISABILITIES**

By
Carmen Porter

A Thesis

Submitted to the
Department of Special Education
College of Education
In partial fulfillment of the requirement
For the degree of
Masters of Arts
at
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Thesis Chair: Jiyeon Lee, Ph.D.

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Dedication

I would like to dedicate this manuscript to my Mom & Dad, my children: Jasmin, Jared, and Julian, along with my friends who helped by supporting me through my educational journey.

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Abstract

Carmen Porter

THE EFFECTIVENESS OF STUDENT RESPONSE SYSTEMS IN TESTING FOR STUDENTS WITH LEARNING DISABILITIES

2013/14

Jiyeon Lee, Ph.D.

Master of Arts in Special Education

The purpose of this study was to examine the effects of a response system by using assistive technology for students with learning disabilities (LD) in 9th grade. By introducing a response method other than traditional pencil and paper, the students had another option to increase motivation and be able to achieve higher test scores. The participants ($n=10$) were randomly assigned into two conditions and ABAB research design was administrated. The results of the study indicated that hands on engaged response system was effective to increase assessment outcomes for students with learning disabilities.

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Chapter 1

Introduction

1.1 Statement of Problems

An assessment refers to observing, gathering, recording, and interpreting information to answer questions and to make legal and instructional decisions about students (Cohen & Spencer, 2011). Assessment is critical in classroom to gather and interpret information about a student and to make instructional decisions. By providing information about that individual's ability, teachers can learn about weaknesses of students in the classroom. Assessments can also give information to support what the teacher knows about the student and what they still have to learn.

The federal No Child Left Behind Act (NCLB) (2001) requires that all students, including those with disabilities, be included in the state assessment system. Because of the mandate of NCLB (2001), assessment has become a central focus for each teacher. This is an area in which many teachers struggle. Because teachers are being held accountable for state assessment scores, finding the right assessment method has become a classroom priority.

According to Badders (2000), there are two types of assessments. These are formative and summative. Formative assessment provides student information to guide the teacher's instruction and decision making; examples include paper and pencil tests, oral reports, and interviews (Badders, 2000). A pencil and paper test, such as a unit exam or a weekly quiz, is considered as a traditional way to evaluate student performance. The test format usually includes multiple choice questions, true and false, and short question answers. Advantages of traditional tests include sound reliability and validity, easy

administration and grading, as well as short time for preparation and less cost. However, traditional tests are usually timed, and rely on the student's ability to remember isolated facts that have been taken out of their original context (Elsworth, 2003). Some students, who struggle with reading comprehension, may have difficulty understanding what the questions ask because of their learning disabilities. Therefore, the exam questions should be very clear and precise for LD students to understand what is being asked. Also, the material covered in these tests may not be practical for students to apply in the real world. Students with special needs have difficulties in test taking (Elsworth, 2003). For example, students with learning disabilities (LD) have difficulty expressing what they know on tests when it comes to writing their thoughts on paper, which may cause their low scores (Elsworth, 2003). A poor score may cause teachers to make incorrect assumptions about the child's understanding and to be unable to develop proper planning for remediation (Elsworth, 2003).

Summative assessment informs both students and the teacher about the level of conceptual understanding and performance capabilities that the student has achieved, such as performance tasks, projects, and checklists (Badders, 2000). Because of the mandate of NCLB (2001), students with disabilities are required to be included in assessments, and accommodations should be provided when needed. An alternative assessment is considered for those students with identified disabilities who are not able to take a regular test. Alternative assessments include exhibits, demonstrations, hand-on experiments, computer simulations, portfolios and projects. Using technology, such as computerized testing, is considered as one option of alternative assessments. Through a study of alternative assessments, it has been found that students are better prepared for

state testing when a computerized test is provided as an accommodation (Goldstein, 2003). It has been also found that technological innovations can make state tests more accessible to students with special needs (Olsen, 2003).

Student response systems (SRS) have been introduced in schools as a technology tool for students to respond to questions (Thompson, 2012). With the SRS, each student has a wireless handheld response pad, called a “clicker” to touch the key to answer questions that the teacher created on a computer and projected onto a larger screen. Once the test is completed, a report of the students’ responses is generated almost immediately for the teacher to see. Such student response systems offer a wide variety of formative and summative assessment options (Thompson, 2012). According to Caldwell (2007), “clickers” allow students to answer questions and voice their opinions anonymously without any judgment from others, which encourages the students to be completely honest and not give responses just to match the ones given by their classmates. Teachers were able to check student responses immediately and give feedback, which engaged students’ participation and showed their understanding of topics (Thompson, 2012). The SRS can also be used in the classroom to design and develop effective instruction benefit students with LD (Alexander Middle School, 2009).

According to Duncan (2005), the advantages of using clickers in the classroom are that student involvement increases because of the anticipation of using the response pad to answer questions and seeing the group responses on the screen. They look forward to the discussions. In his study, the students became more active learners and class attendance was improved (Duncan, 2005). Another advantage for using “clickers” is that they enhance the ability of the instructor to monitor student learning and to

immediately respond to students' needs for clarification or additional practice (Briggs & Keyek-Franssen, 2010).

According to Caldwell (2007), “clicker” applications being used more frequently in university classrooms to instruct a large number of students. The “clickers” help promote classroom engagement and higher attendance rates. Professors use the “clickers” to take attendance, administer exams and hold class discussions. “Clickers” are also used in high school classrooms (Crumrine & Demers, 2007). For example, the “clickers” allow the teacher to survey students to determine their level of understanding of recently taught concepts and anonymously respond to questions, along with immediately graphing the responses for class to review (Crumrine & Demers, 2007). This helps the students prepare for their future assessment. According to Lynch (2009), “clickers” can be used in the inclusive classroom to increase student learning, engagement, and participation in class for students with and without disabilities. Although it was found that the use of “clickers” with students with special needs is available, the amount of research on their use is very limited. More studies are needed to apply this technology in the classroom, especially for students with disabilities.

1.2 Significance of the Study

Assessments enable teachers to gather and interpret information about a student and to make instructional decisions based upon the student’s individual’s performance. Using technology, such as clickers (SRS) in responses to questions in test taking is one form of assessment, helped increase class participation (Briggs & Keyek-Franssen, 2010). Although some research has focused on the use of adaptive computerized testing such as allowing students with hearing impairments to use American Sign Language for

reading test problems (Goldstein, 2003) and, using a computer to read questions aloud for students with reading disabilities or visual impairments (Goldstein, 2003) little research has been found in the use of technologically supported assessments for students with LD. More studies are needed in the area of using technology in assessment to evaluate its effectiveness. This study is designed to compare the test results of students with LD when using clickers to the results of assessments using pencils/pens in order to compare the different types of assessment for students with LD to determine which is most effective in demonstrating achievement. In addition, feedback from the students about their experiences as they participated in the alternative assessment will be collected.

1.3 Purpose of the study

The purposes of this study are to: (a) compare the test results of students with LD when using clickers or pencils/pens, (b) obtain feedback from the students about their experiences as they participated in the alternative and written assessment experiences.

1.4 Research Questions

1. Are there any differences of test scores of students with LD when they take tests using clickers or pencils/pens?
2. Are there any differences of their experiences in taking tests using clickers or pencils/pens?

Chapter 2

Literature Review

Assessments are important for teachers to determine student performance in order to make decisions for their instruction (Frey & Schmitt, 2007). No Child Left Behind Act (NCLB) of 2001 mandates that all students must be included in school assessment systems including those with disabilities. Thus, a statewide assessment has been adopted for 3rd-8th and 12th graders to evaluate student performance at the end of the school year based on alignment of the state academic content standards. Accommodations are provided for those with special needs along with implementing an alternative format of assessment for those who are not able to take traditional paper and pencil tests. This chapter reviews research on traditional tests with paper and pencil, challenges of student with learning disabilities in testing, and using the Student Response System (SRS).

2.1 Formative Assessment

There are two types of assessment, one is formative and another is summative. Formative assessment uses evidence of student performance to guide teachers to revise their teaching strategies for better instruction based on the students needs. It has been found that formative assessments can provide information about student's performance to teachers, so that they can evaluate their instruction and to understand what should be re-taught or practiced in order to reinforce student's learning, especially for low-achievers (The Center for Comprehensive School Reform and Improvement, 2010). According to The Center for Comprehensive School Reform and Improvement (2010), the assessment should be aligned with the state mandated curriculum standards which include involving

learners in the learning process by providing instructional feedback that explains their assessment results.

Formative assessments may involve learners in the testing process by allowing them to reflect on their incorrect answers. Most formative assessments include a rubric developed to help students reflect on their work. This allows teachers to use the reflections to make future assignments more suited for their students. This process will help students learn from their mistakes and understand the correct answers by comparing the right and wrong to avoid the same mistakes in the future (Badders, 2000).

Assessment outcomes provide teachers instructional feedback that will enable them to reinforce precisely and understand what students learned well, what they were expected to learn, and what needed to be re-taught. This way they can provide advice to the learners to improve their learning in the future.

Badders (2000) indicated that formative assessments provide information to help guide teachers' instruction. The assessment should evaluate student's acquisition of knowledge by determining what students have mastered, and what they still have to learn. One type of formative assessment is the use of traditional paper and pencils, which serves as practice for students throughout the school year to prepare for the state assessment tests (Sasser, 2013). The advantage of traditional pencil and paper tests is that they are easily administrated and graded with short time for teacher's preparation and cost less (Elsworth, 2003).

Some disadvantages of pencil and paper tests may include being timed and relying on the student's ability to remember isolated facts taken out of their original context (Elsworth, 2003). Some students with LD may need extra time to write their

thoughts on the paper. They may even struggle to remember facts needed to answer test questions. Other students with LD may not do well because of their difficulty reading test questions, which may lead to selecting incorrect answers on the multiple choice questions.

A comparison of the traditional pencil and paper and computerized testing was conducted by Millsap (2000). In this study, a total of 227 students participated. The students were divided into twelve classes. Six classes, containing a total of 109 students, took the test with paper and pencil format. The other six classes, containing a total of 118 students, took the same test using computers. The results showed that there was no significant difference between test administration modes. The outcomes of the computer-administered tests were nearly identical to those of the traditional paper and pencil manner and there were no significant effects on student achievement. Students in one of the computerized groups scored a little higher than those in the pencil and paper test group on one of the tests. It seems that the novelty of the computers may have contributed to this difference because the students had not been exposed to computers in the class environment before their testing. It was suggested that introducing technology to students at an earlier stage would have prevented this issue (Millsap, 2000).

Noyes and Garland's study (2008) analyzed different assessment formats used with reading. The assessments focused on reading speed, accuracy and comprehension. The reading speed of the students was 20-30% slower for test takers using computers than pencil and paper. Their reading accuracy was better using pencil and paper because it was easier for their eyes than reading from computer screens. Their comprehension level of the pencil and paper test was higher than their computerized test. This was

because the students found it easier to read the words on paper than the words on the computer screen. This information allowed teachers to decide which assessment could be effective to evaluate student performance. It was asserted by the authors that by developing more studies for computerized testing verses the traditional with pencil and paper, the findings may become clearer. Although the results of some studies favored using paper and pencil (e.g. Van de Vijver & Harsveld, 1994; Russell, 1999), others preferred computerized testing (e.g. Vansickle & Kapes, 1993; Carlbring, 2007). It was found that most of the studies indicated no difference between the two types of assessments on student's performance (e.g. King & Miles, 1995; DiLalla, 1996).

2.2 Summative Assessment

Summative assessment informs both students and teachers about the level of conceptual understanding and performance capabilities that students have achieved, such as performance tasks, projects, and checklists (Badders, 2000). The purpose of summative assessment is to determine the student's overall achievement in a specific area of learning at a particular time. Moss (2011) examined 19 studies using summative assessments in various classrooms. Formative assessment, such as the state tests, may raise anxiety among the students and cause low self-esteem. This is due to the students lacking confidence because they usually receive poor scores when testing. With the summative assessment, students are more engaged in the learning process and are more willing to be involved in challenging debates and collaborative discussions with classmates because most summative assessment involves students completing activity based products, such as projects (Moss, 2011).

By reviewing 23 studies involving students from aged 4 to 18, Moss (2011) summarized that when teachers use summative assessments to keep records of student progress, making decisions, and reporting to students and parents, the students know that they should be accountable. Moss (2011) also stated that that when teachers used summative assessments for vocational qualifications, students benefited from the descriptive nature and real life experiences. Summative assessment is the formal testing to evaluate students' learning outcomes in order to produce grades, which may be used for various reports, as well as teaching effectiveness. Some advantages mentioned by the Highland Council (2006) indicated in their report that summative assessments include various types of assessment to check understanding, to show individuals' progress toward learning goals, and to motivate students to complete the test. Some disadvantages include limited preparation time for teachers to plan activities within the curriculum and to develop a common ground for test questions. Teachers are diverse when it comes to making up teacher made tests; therefore, no test is ever the same. Another type of assessment choice that could be used to check for student understanding is to use the Student Response System (SRS).

2.3 Student Response System (SRS)

Electronic Student Response System (SRS) or “clickers”, have a keypad as a remote device for students to respond to teacher's questions. By pressing a button on the keypad, students anonymously send their responses to a receiver attached to a computer that displays histogram questions designed to assess their understanding either while a lesson is in progress or after it has ended. Although the student responses are anonymous

to their peers, teachers can track students by their clicker number to monitor students' participation and correct misconceptions.

Using clickers for self-confidence and classroom performance was examined in math instruction in Alexander Middle School (Artati, 2009). A total of 17 students with ADHD participated. Two studies were conducted. In the first study, students were taught math skills in a traditional way and then taught math skills using clickers. The purpose was to evaluate student interest in learning math by using the clickers in class instruction. For the second study, the students were asked to respond to questions about their perceptions of their math learning experience. Teachers assisted students as they responded to an online survey using the classroom computer. After the clickers were used in the math class, the survey process was repeated. The results showed that by introducing clickers to the math class in the first study, students were more engaged because they felt that their responses counted (Alexander Middle School, 2009). They had a higher interest in learning math without frustrations, and a better tolerance on completing tests/quizzes with the use of clickers. They paid more attention to learning math and found it was easier to answer questions without the fear of being wrong. It was also observed that students were more eager to answer questions during the lesson with clickers than when no clickers were provided.

Gorder's study (2008) demonstrated similar findings. This study included 700 college students. The procedure was to test half of the classes traditionally with paper and pencil and half of the classes with clickers. The class was given a pretest before the quarter of the semester started, and a related post-test after the quarter was complete. The

teachers calculated the classes' average gain scores to compare the post-test scores to the pre-tests.

The results showed that student participation increased tremendously when clickers were used. During the 2006-2007 academic years, classes using clickers outperformed the non-clicker classes by an average of 10 % in their final exams. The classes that used clickers scored higher (72%) on multiple choices questions than the classes without the clickers (61%). Both the male and female students almost scored the same percentage rate in the clicker classes. Females had a score gain of 6.2 % and males gained 6.7 %. In the non-clicker classes, the female score gain was 4.3 % and the male was 6.6 %. When the clickers were used, the females scored higher. The males stayed in the same range for both the non-clicker and clicker tests.

Similar results have been found in AhYun and Lojo's study (2010) to evaluate the effect of clickers on student learning. A total of 942 college students enrolled in research courses in the areas of Communication Studies and Operations Management participated. Of those, 480 were female (51%) and 462 male (49%). The participants were assigned into 2 groups, one was experimental to use clickers and another was the control group without clickers. Student midterm and final examination grades were compared as well as survey data used to obtain their perception about their experience in using clickers.

The results revealed that the use of clickers increased student motivation during their-learning process (AhYun & Lojo, 2010). Students reported that they were satisfied with the use of clickers because clickers increased their interest and motivation to participate in class. In addition, the findings are consistent with other studies using clickers (Gorder, 2008; Chasteen, 2009; & Lynch, 2009). It seems that clickers can serve

as a useful teaching device to enhance students' active learning, participation, and enjoyment of the class (Caldwell, 2007). Overall, these results are promising in that the use of clickers throughout class instruction could have a positive impact on student learning.

2.4 Challenges of Students with LD in Testing

According to the National Association of Special Education Teachers (2007), learning disabilities have an effect on either input (e.g. the brain's ability to process incoming information) or output (e.g. the person's ability to use information in practical skills, such as reading, math, spelling, etc.) of learning process. According to Lynch (2009), some students with LD could have challenges during the testing process. The challenges may include poor reading skills that hinder their understandings of the problems listed in the test; slow reading pace that delay their time to complete the answers; and short attention span that distract themselves during a required time period for testing. For example, some of them have difficulty in understanding the questions, which may delay completing the required test in certain amount of time. Thus, when some classmates finish their test, other LD students may still need more time to try to figure out the answers. Definitely, this will cause a delay in responding to the rest of the test questions. Another challenge these students may face is that they may lose focus easily and become distracted. For example, if they have difficulty responding, they may lose their focus becoming inattentive due to their short attention span (Lynch, 2009). If the test is not on a topic of interest, they would become destructive and present off task behaviors (Lynch, 2009). It was found by the National Association of Special Education Teachers (2007), that a learning disability is caused by the way a person's brain processes

information, which makes difficulties in processing skills such as memory, visual and auditory perceptions, resulting low achievement in at least one subject area such as reading, math, or writing (Steele, 2005). Most of these students have poor reading skills, struggle to understand word problems, identify reasoning, and distinguish relevant information (Steele, 2005). It was also found by Elsworth (2013) that these students have anxiety once a test is given with pencil and paper because they often have difficulty expressing themselves in writing due to poor performance in language learning. In order to support these students, alternative ways may need to be considered in administering tests.

Using clickers may be an alternative way for these students to take tests. The clickers provide an alternative way for students to demonstrate knowledge other than through oral and written expression and engage students in a high-interest activity that is different from a pencil-and-paper test (Lynch, 2009). They do not have to worry about misspelled words, wrong answers, other's opinions, because the answers are anonymous. The clickers allow students to use a handheld remote control with letters/symbols that resemble the video game and T.V. remotes they are used to. In order to use clickers effectively, Lynch (2009) made the following suggestions. First, teachers may provide longer time for these students to respond to questions. This way, the fact that students have different rates of thinking and problem solving techniques is accounted for. It was recommended that teachers use the "count up" timer feature of the SRS, which enables teachers to keep the question open until all students have comfortably been able to respond. Second, teachers may read test questions aloud, using simple language and limited response choices. Third, teachers should manage students to avoid calling out

answers, playing with the clicker, and distracting peers. Using technology, such as clickers, has potential to support students with special needs, especially those with LD (Lynch, 2009). Clickers provide an opportunity for students with low self-confidence to respond with less fear of having the “wrong” answer (Lynch, 2009). It’s a hands-on experience to replace pencil and paper tests and may allow students for interactive engagement with other classmates in the classroom.

2.5 Summary

The review of literature summarized the two types of assessments, formative and summative, and whether pencil and paper tests or Student Response System (SRS) benefit students in the classroom. Traditional paper and pencil tests are used often in classrooms. Based on the research of paper and pencil testing versus computer testing, the results favored paper and pencil test. Traditional paper and pencil tests are easier for students to comprehend and review, it takes less time to complete than using a computer, is better on eyes and costs less. There is limited research on using the SRS as an assessment method. Instead, most of the studies covered using the SRS in class discussions to promote participation. As more studies develop for computerized testing verses the traditional with pencil and paper, the findings may become clearer about which method gets better student test scores. Although the results from Noyes and Garland’s study (2008) favored using paper and pencil, other studies may favor computerized testing. Overall, it was found that most of the studies indicated there was no difference between formative and summative assessments on student’s performance.

Assistive technology can be adapted as a new response format for class discussion and testing. Clickers can increase the learning engagement, and participation of students

with special needs (Lynch, 2009). For example, clickers had a productive effect on students with ADHD and students without disabilities (AhYun & Lojo, 2010). They boost student attendance and motivation to participate in class discussions (AhYun & Lojo, 2010). Previous research provided positive results. However, there was insufficient research on the comparison between using clickers and pencil and paper testing. This study attempts to extend previous research to compare the student performance when tested with different formats, traditional paper/pencil and SRS using clickers.

Chapter 3

Methodology

3.1 Participants

The participants of this study attend a vocational program. 10 ninth grade students participated in this study. The students were classified as LD and were in the age range of 14-15 years old. They were very high functioning students who needed accommodations such as extra time on their tests and/or help with comprehension skills to understand the information presented from the lesson. The classes are very diverse and the participants of this study included 4 African- American students, 5 Caucasian students, and 1 Hispanic student. These students come from different schools around the county. These self- contained classes are an hour long each and are set up in three sections (11 in one group and 10 students in the other two groups).

3.2 Setting

This study was conducted at a vocational high school in South Jersey. The vocational school is 1 of the 5 campuses that make up the school district. The other four campuses have students who have been identified as having severe disabilities. The students who participated in this study were part of a unique program that allowed special education students to receive additional support so they are able to attend the various shops offered in the vocational school. There were three teachers who taught in this program. One teacher taught Law, CADD, ROTC and Graphics. Another teacher taught Automotive, Welding, and Construction. The teacher conducting this study taught Allied Health, Child Care, Culinary Arts and Cosmetology. These students were taught information about each of the shops offered throughout the school and given a chance to

shadow with other students in the different shops that were available to get hands on experience from other advanced students in the program. The test information for this study focused on the Allied Health portion of the program. The program was divided into 3 classes. One class had 11 students and the other two classes each had 10 students in them. The classes lasted an hour long each. After the 3 hours, they returned to their home schools to be taught their academic classes so they could meet graduation requirements. The teacher who completed this study is certified in special education.

3.3 Materials

3.3.1 *Instruction Materials.* The Vocational Technical School follows the 21st Century Skills Curriculum that was developed to expose students to multiple areas of a concentration in order to select a field that best compiles their skills, interests, and abilities. The lessons for this study followed the school's curriculum and focused on skills needed for students to find a career after high school. This study was developed to determine a way for students to have a better experience with testing. By introducing a method other than traditional pencil and paper, the students were given another response option designed to increase motivation and achieve higher test scores. The study focused on the topic of Allied Health and the instructional materials were obtained from a book called "First Aid-Responding to Emergencies" by The American National Red Cross, (2001). The lessons were presented through PowerPoint presentations and modeling of hands-on techniques, which the students would have to present to show skills learned. Some examples of hands-on techniques were showing students how to do CPR, the Heimlich maneuver, and rescue breathing on a CPR adult manikin or a CPR child manikin. The information for the lesson was taken from the specific chapters and placed

in a Power point presentation. Picture slides from the Internet were added to help the visual learner have a better understanding of the lesson. The students completed the study questions at the end of each chapter to prepare for each test. Every Wednesday they were given a study guide to review so they could prepare for the test given each Friday.

In addition to written assessments, students took four assessments using the Student Response System (SRS), which are known as “clickers”. The clickers are handheld remotes that were used by the students to enter an electronic test answer. The complete system was downloaded onto the computer from the given software. The clickers were kept in a bag that was kept in a locked closet until ready to be used. Once the bag was opened, the students could see that the clickers were organized numerically. The students were told their numbers and they would use that same number for each test. On the test day, the students were instructed to get the clicker with their number on it. The instructor reviewed how to sign on the “clickers” with the students. They were originally shown how to sign on, where all the buttons were located, and how to enter their answers a few weeks earlier during a class discussion that was set up in the same format as the test questions.

3.3.2 Measurement Materials. The assessments are consistent with set up of the paper and pencils assessments. The test consisted of true and false questions, along with multiple-choice questions. There were 20 questions on each assessment.

The first sets of students were given six assessments on various health topics, such as the following titles: Help Can’t Wait & Taking Action, Body Systems, Checking the victim, Breathing Emergencies, Substance Misuse and Abuse, and Sudden Illnesses.

Help can't wait and taking actions were combined to make the first test. This covered learning about the emergency medical services available and how to react in emergency situations. The second test was on body systems. The students identified five body cavities (cranial, spinal, thoracic, abdominal, and pelvic) and their functions, along with identifying the eight body systems (respiratory, circulatory, nervous, musculoskeletal, integumentary, endocrine, digestive, and genitourinary). The third test was on checking the victim. Students learned to identify life-threatening conditions and how to care for the victims. The fourth test was on breathing emergencies. They learned about respiratory distress and how to treat conditions. The fifth test was on substance misuse and abuse. Students learned about commonly misused or abuse substances and how to care for a person who has misused substances. The sixth text was on sudden illnesses. Students learn the signs and symptoms of sudden illnesses (fainting, seizures, diabetic emergencies and strokes) and how to care for these situations. Three assessments were administered as paper and pencil, while the other three were administered with the use of the clickers.

The second sets of students were given the same six assessments as the first set, but with one additional test on poisonings. For the seventh test, the students learn signs and symptoms of poisoning and how to treat victims. Three assessments were administered as paper and pencil, while the other four were administered with the use of the clickers. The test consisted of true and false questions, along with multiple-choice questions. There were 20 questions on each assessment.

In addition, students completed the feedback survey to see if completing the clickers test was a better experience than the pencil and paper test. The survey consisted

of 5 questions to obtain the student's responses. They completed the survey in a paper form and the responses are presented in a graph to show results.

3.4 Research Design

To complete this study a single subject research design was used with A B phases. In the first phase students completed a written test as a baseline. Lessons were taught over 2 weeks using the SRS technology to answer discussion questions. This was put in place to introduce the clickers so students would know how to use them before using them for testing. For the second phase students were tested using paper and pencil assessment while the other times assessments were completed with the use of clickers to see which assessments had higher academic scores over a six-week period. The last part of this design was for students to complete a 5-question paper survey on their testing experience they had while testing with the traditional paper and pencil verses testing with the use of clickers.

3.5 Procedures

Guardians of participants were given an introduction letter in which the procedure of the study was outlined as well as importance of the study, and permission to conduct the study with their children as participants. All of the participants' guardians gave permission for their child to participate in the study.

The students were given a test to set the base line for this study. Once the baseline was set, the clickers were introduced to the class. This was done by explaining the process to them. They were told that they would be participating in a new way to have class discussion. They were then told there would be a question that would appear on the screen. Each person was asked to answer the question by using the hand held clickers.

They were also told not to say their answers out loud. The “clickers” were then passed out to each student and an explanation was provided on how to use them. The buttons they used were pointed out to each student. They were shown where the buttons were located to answer true and false. They were also shown the keys they needed to answer the multiple-choice questions. The students were then taught how to sign on to their clicker. They had to press the power button, put their given number in the clicker, and then push the power button again. Their clicker number showed up on the screen to verify they were signed into the program. A sample true or false question was placed on the board to try with students. Once the question was on the board, the teacher read it out loud to students. After question was read, the students were asked to make a selection by selecting the true button or the false button. Once they had made their selection they were asked to place the clicker in the right corner to show they were done. After all selections were made the teacher showed the class the results they selected. The class then discussed the results from their classmates. Discussion with the clickers was part of the lessons for 2 weeks until introducing them for assessments. The students took a series of seven tests for this study. The clickers are connected to the main computer. When it came time to take the tests, the teacher gave a review of how to use the clickers again. For the first test the true/false buttons were pointed out as well as which buttons to use with the multiple choice. The questions are shown on the white board. Students make their answer selections for all of the test questions. After everyone makes their selection, the next question is presented to them. This process repeats until all questions have been shown. Once the test is completed, the instructor runs a report of the grades to see what each student received. It also breaks down each of the questions to show what percent of the

class got that question wrong. Although the clickers were used anonymously in class discussions, the tests were connected to each student by their clicker number. Only the teacher could view this information. The tests were reviewed with each student in private conferences so they can see what questions they missed. The lessons were taught in a week's timeframe at each time. All tests were completed at the end of the week on Friday. The first 3 tests were administered as a traditional pencil and paper test while the next 4 were administered using the clickers. All lessons and tests were given in the same classroom. Each test, whether paper and pencil or using clickers, were read out loud in its entirety to all the students in the class. Once all of the tests were completed, a survey was handed out for the students to complete about their experiences while taking the traditional pencil and paper test in comparison to the test using the electronic clickers. The survey contained 5 questions. The survey paper was handed in to the instructor as soon as the student completed it. All data collected was organized in tables and graphed to show results of the study.

3.6 Data Analysis

The students' scores on assessments were recorded in a graph and compared to the baseline test that was graded. Survey questions were asked to determine whether or not the use of technology would increase students' motivation to complete tests and increase their test scores. Each student's performances were recorded and graphed to demonstrate his or her progress. The survey represented how each of the students felt during this study. These results were also charted and graphed to show their responses.

Chapter 4

Results

Overall, the class excelled with the testing process. Their results are in table 1. Both classes scored higher when using the clickers to complete their tests. Class 1 had an average of 17.1 out of 20 (85.3%) correct problems using the clickers. Class 2 had an average of 17.7 out of 20 (88.7%) correct problems. Class 2's scores were 3.4% higher than class 1 with the clickers. Class 1 had an average of 15.2 out of 20 (76%) correct problems with the paper test. Class 2 had an average of 16.3 out of 20 (81.7%) correct problems with the paper test, Class 2's average was 5.7% higher than class 1 when then took the test with paper. Class 2 scored higher in both the paper and clicker tests than class 1.

Class 1 results are in table 2. This class took 2 paper tests. The average of the first test was 81%. This was 10 percentage points higher than the second paper test average, which were 71. Three out of the four-clicker tests had higher averages than the paper tests. The average percentages were as follows: the third test was an 84; the fifth test was an 89; and the sixth test was a 90. Although the student's scores dropped on the fourth test to a 78, the fifth and sixth averages showed increases. Class 1's average for the clickers was 85.3%. The paper average was 76%. This class showed a 9.3% increase in average results when they used the clickers. Their survey results were in table 4. Only one student out of 5 said they were more comfortable with the paper test. The other 4 students picked the clickers as their choice of test method to answer all the other questions.

Class 2 results are in table 3. This class took 3 paper tests and 3 tests using the clickers. The students stayed in the average range of 81-83 when they took the paper tests. Their average percentages were as follows: test 1 was an 81; test 2 was an 83; and test 3 was an 81. The average of all three tests was an 81.7%. The clicker tests showed an increase in average each time the students were tested. Their averages were as following: the fourth test was an 87; the fifth test was an 89; and the sixth test was a 90. This gave an overall average of 88.7%. The clicker average was 7% higher than the paper average. The survey results for class 2 are in table 5. One student said they preferred the paper test method. They said they scored higher and was more comfortable taking the paper test. The other 4 students said the clicker was their choice of test method for all the questions asked.

Table 1
Summary of Test Results

	Clickers		Paper/Pencil	
	Mean (#)	Mean (%)	Mean (#)	Mean (%)
Class1	17.1/20	85.3	15.2/20	76.0
Class2	17.7/20	88.7	16.3/20	81.7

Table 2
Class 1 Individual Test Results

	Paper Tests		Clicker Tests			
	Test1	Test2	Test3	Test4	Test5	Test6
Student 1	75	45	65	90	95	95
Student 2	75	70	85	70	70	90
Student 3	85	85	85	70	90	70
Student 4	80	95	100	70	95	95
Student 5	90	60	85	90	95	100

Table 3
Class 2 Individual Test Results

	Paper Tests			Clicker Tests		
	Test1	Test2	Test3	Test4	Test5	Test6
Student 1	75	80	70	80	80	85
Student 2	95	80	85	95	95	90
Student 3	90	95	90	95	90	85
Student 4	75	70	70	85	95	95
Student 5	70	90	90	80	85	95

Table 4
Class 1 Survey Results

	# of students who chose paper/pencil test	# of students who chose clickers
Which test did they prefer?	0	5
Which test did they feel more comfortable with?	1	4
Which test did they score higher with?	0	5
Which test was easier to complete?	0	5
Which way would you prefer for future tests?	0	5

Table 5
Class 2 Survey Results

	# of students who chose paper/pencil test	# of students who chose clickers
Which test did they prefer?	1	4
Which test did they feel more comfortable with?	1	4
Which test did they score higher with?	1	4
Which test was easier to complete?	0	5
Which way would you prefer for future tests?	0	5

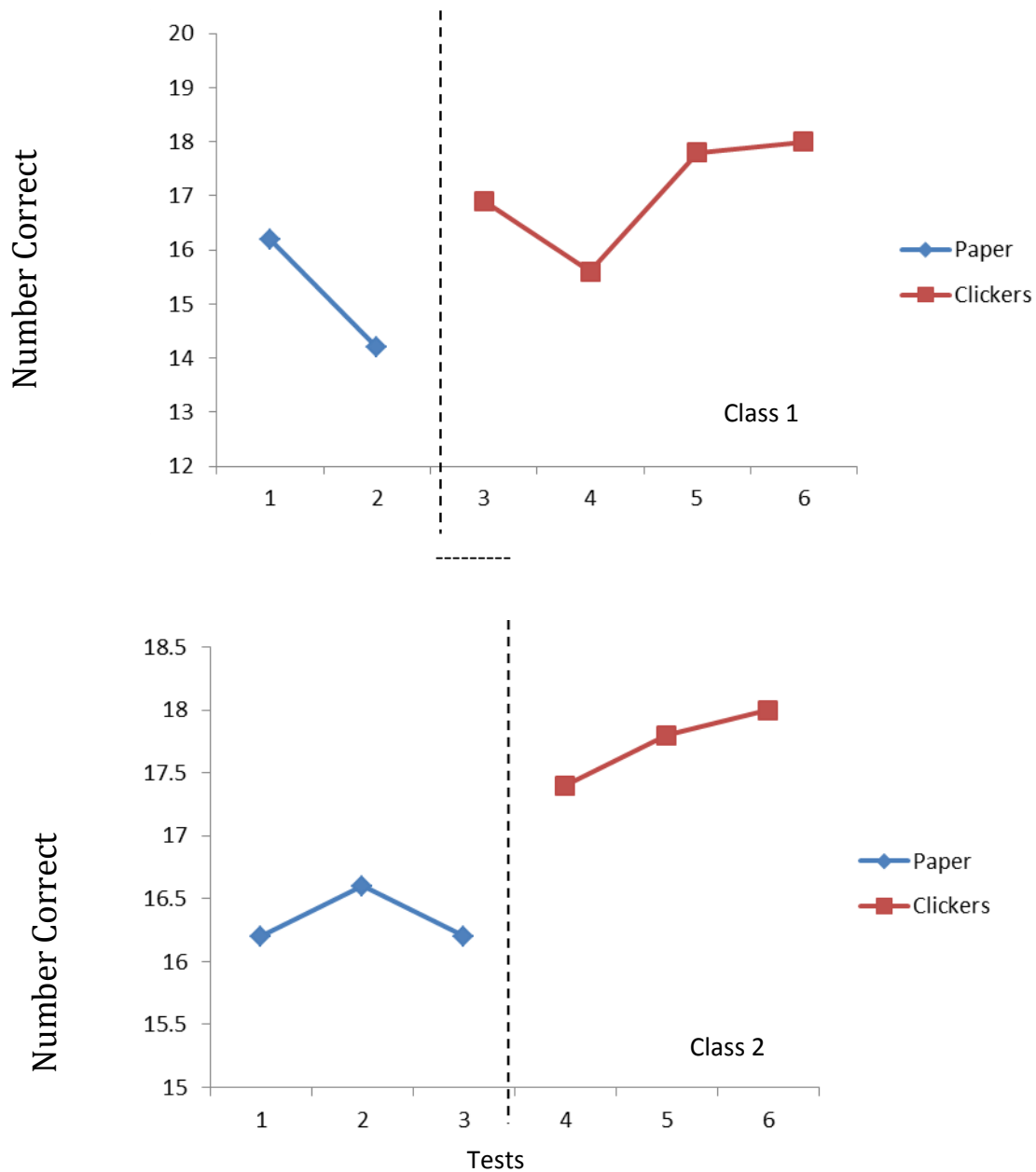


Figure 1. Results from testing with clickers vs. paper and pencil

Chapter 5

Discussion

The results of the study indicated how effective using clickers were for the students with Learning Disabilities and also showed students had positive testing experiences. By using clickers as part of the group discussion process in the classroom, the teachers can check for student understanding of the material presented through the lesson. Based on the results of this study, clickers can also be used to take assessments to increase student's test scores in the classroom.

There were several limitations in this study. One limitation was that the students could not look back at their answers once they moved on to the next problem. This was a limitation of the testing process because the students felt as though they did not get a second chance to review their choices they made with the clickers. Instead, the student's had to wait for test to be scored to review their answers. With the paper test, the students had the opportunity to look over their entire test for mistakes before handing it in for a grade. Secondly, testing procedures that involved testing time delay might be a limitation. For example, students had to wait for the other students to respond to the test question before being able to move on to the next question. Some students got frustrated and tried to rush their fellow classmates. Another limitation was that teachers were limited on the type of questions used for the assessment. True/false and multiple choice questions were the only formats that could be used. Absenteeism was another limitation. When students were absent on test day, time had to be allocated to give the test to those who missed it. This altered the normal class time procedures.

Although there are many studies on using clickers in the classroom, the research

of using clickers with assessments is limited. In the future, more teachers and researchers should use clickers and complete studies in classrooms to support the findings found in this study. The studies could show other teachers there's another way of testing students in their classrooms. With technology growing in the classroom, clickers could be part of education's future.

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