HOW IS STUDENT ACHIEVEMENT ON ASSESSMENTS IMPACTED BY THE USE OF COMPUTER BASED TESTS?

by

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In presenting this professional paper in partial fulfillment of the requirement for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

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ABSTRACT

In this investigation assessments using classroom technology were implemented with the purpose of looking for the effect that computer based testing had on student achievement. This study involved a comparison between the use of pencil-paper tests and computer based tests. The data was used to analyze the use of computer based tests and the effect on student achievement of students in a 5^{th} grade science classroom.

INTRODUCTION AND BACKGROUND

Introduction

In our modern day society, teachers are faced with the challenge of high-stakes testing as a measure of the effectiveness of their teaching. The rigorous testing required of students in the state of Texas heavily influences the content taught and the delivery method that teachers employ during the instructional day. The testing schedule for science is currently set at 5th grade, 8th grade, and EOC (End-of Course) exams are required in at least one science: biology, chemistry, and/or physics at the high school level. With teacher quality being assessed in relation to test scores, seeking the best instructional practices as well as the best assessment practices for student success on these tests has become an important aspect to education. Our focus has gone from doing what is best for kids, to doing what is best for kids so that they score well on a standardized test.

Project Background

Teaching and Classroom Environment

Over the last two years I taught at the largest middle school in the state of Texas with over 1,800 sixth through eighth grade students. Last summer, I moved to a much smaller district, about ten miles away and am now the only 5th grade science teacher in the district. I currently have approximately 130 students that I teach throughout six class periods each day. This employment transition has required me not only to shift my focus on instructional objectives for younger students, but also to incorporate adequate preparation for students to be successful on a state assessment in my content area. As a result of not being in a larger district, I no longer have access to an instructional specialist

who provides benchmark assessments or unit tests, thus I will be creating my own. This added task allowed me to question which method of assessment students are more successful in as well as which is most effective for my personal teaching practice: computer based assessment or standard paper/pencil assessment.

School Demographics

This is my first year to teach at H. G. Temple Intermediate School located in Diboll, Texas. My classroom is the only 5th grade science classroom. I see around 128 students throughout the day during six 50 minute class periods. My classes consist of between 20 and 23 students. The majority of my students qualify for free or reduced lunch, as I teach at a Title I school. There are 70 boys and 58 girls. The demographic breakdown by race is as follows: 37 White/Non-Hispanic, 71 Hispanic, 15 Black/Non-Hispanic, 4 mixed race, and 1 Asian Pacific student. Twenty-two students qualify for special education services including ten special education students, and 12 students qualifying for accommodations under the 504 umbrella (Diboll ISD DMAC, 2013).

Diboll Independent School District is located in Deep East Texas, 120 miles north of Houston, Texas. Diboll ISD consists of 1,990 students in grades PK3-12th grade and H. G. Temple Intermediate serves approximately 350 of those students in grades 4-6 with one life skills class and one adaptive-behavior class.

Content and Curriculum

The science program in 5th grade consists of 50 minutes of instruction 5 days a week during the instructional day. All students participate and are not pulled out for any interventions for any other subject area since science is a tested subject area in 5th grade.

We cover a wide range of content from physical science, earth science, and life science including: properties of matter, forms of energy and their uses, effects of forces, sedimentary rock formation, fossils, sources of energy and alternative energy sources, relationships between the sun, moon and earth, and food chains/webs, adaptations, ecosystems and life-cycles. Throughout the school year, process skills are embedded within content strands and the state recommends at least 60% of instructional time be hands-on lab activities. With the increasing low-socioeconomic population in Diboll, it has become an evident problem that students are struggling with the rigor of state assessments.

Focus

As a district, Diboll Independent School District has adopted a technology grant system. Each campus is designated a specific number of funds according to the number of students at that campus. The teachers on that campus are able to write grants for specific technology needs they have in their classrooms. The campus principal and district technology director then choose the grants that are approved each year. The previous 5th grade science teacher wrote a grant for a class set of iPads to use in the classroom. These iPads remained part of the 5th grade materials, thus allowing me to utilize this technology in my classroom. I am grateful for the availability to incorporate this very relevant tool in my classroom as the students show great interest in using this up-to-date device.

Focus Questions

While evaluating different methods to incorporate the iPads in my classroom, and knowing that students already are taking computer based assessments in their reading and

math classroom, I wondered how that could translate into the science classroom as well. I questioned what would have the most impact on my student's success on these assessments in my classroom. As my thinking about this topic evolved further, four questions were developed that I hope to answer during my research, data collection and data analysis.

1. How is student achievement on assessments impacted by the use of computer-based tests?
2. What are the advantages/disadvantages to computer based testing?
3. How are student attitudes about assessment affected by the use of computers during assessment compared to traditional paper pencil tests?
4. What are the effects of computer based tests on me as a classroom teacher?

CONCEPTUAL FRAMEWORK

Introduction

The state of Texas assesses science in 5th and 8th grades using the STAAR exam, State of Texas Assessments of Academic Readiness. The science section of the STAAR exam is divided into four reporting categories, including: "Matter and Energy," "Force, Motion and Energy," "Earth and Space," and "Organisms and Environments." Within these four reporting categories, process skills are embedded and approximately 60% of the questions are dual-coded as both content and process skill. In the 5th grade, students have four hours to complete a 50 question assessment that includes standards from third, fourth, and fifth grade curriculums (Texas Education Agency, 2010).

> The Texas Education Agency (TEA) is pursuing initiatives to include computer-based testing (also known as online testing, electronic testing, or

> eTesting) into most of its assessment programs. The motivations for moving to computer-based assessments include greater flexibility in administration, reduced administration burdens on district personnel, and the possibility of faster score reporting. In general, the movement toward electronic testing in K–12 assessment programs is picking up momentum as schools increase their technology capabilities and students become more comfortable using the computer for a variety of educational tasks (Texas Education Agency, 2008, p. 6).

The Comparability of Computer Based Tests vs. Paper-Pencil Tests

How students learn in science and how teachers should teach science has been a widely debated topic. In today's technological world, where a focus is on 21st century skills and technology usage, now the debate includes to how we should assess students. According to the Texas Education Agency in their executive summary, "Whenever paper- and computer-based assessments of the same content are administered, professional testing standards and federal accountability both require evidence showing comparability of test scores obtained in the two administration modes"(Texas Education Agency, 2008, p. 6).

Pearson Education, Inc. is contracted by the state of Texas from the 2010 through 2015 school years. As part of a testing, measurement and research service, Pearson looked at the numerous comparability studies done over the last twenty years regarding computer based testing (CBT) and paper-pencil tests (PPT).

> Although the majority of recent comparability studies have indicated that CBT and PPT are comparable across delivery mediums, the results are not

> unanimous. The inconsistency in the findings is not surprising, given that these comparability studies involve a wide range of variations in content areas, participants, data collection designs, and item format (Texas Education Agency, 2008, p. 2).

Several studies are looked at in depth and their results are analyzed. The authors conclude that "Although the findings from various comparative studies are not consistent, there seems to be a trend that the CBTs are comparable to their PPT counterparts" (Wang & Shin, 2009, p. 4). As technology availability increases, student experience increases, and student attitudes about online testing indicate a preference for CBT, comparability between versions of paper-pencil tests and computer based tests should not be taken for granted and testing equivalence should still be investigated to ensure fairness.

Advantages and Disadvantages of Computer Based Assessments

With the inconsistency of findings across numerous comparisons, it is important to look specifically at the advantages and disadvantages of computer based assessments. Noyes and Garland discuss potential advantages and disadvantages of online assessment, stating that the benefits of using computers in assessment can be divided into five main categories. These relate to the following: The richness of the interface, the user population, standardization of test environment, online scoring, and quantity and quality of composition output. The disadvantages can be categorized into five groups as well, including: lack of a controlled environment, computer hardware and software, the computer screen, the difficulty to attain equivalence with computer and paper presentation, and concerns about confidentiality. The authors of this study also mention the user preferences for the two different types of media. During their analysis they state:

> One of the early concerns is related to the need to be able to use a computer and some studies have noted the increased computer anxiety associated with online assessment. However, as the population becomes more computer literate, this concern should fade. User preference certainly seems to support the use of online assessment (Noyes & Garland, 2008, p. 1370).

Student Attitudes about Mode of Assessment

In an ongoing study conducted by Al-Amri, which included 167 second language learners, researchers explored the comparability of paper and computer-based testing in their second language reading context and the impact of test takers' preferences. For example, the study emphasizes computer familiarity, attitude toward computers, preference of testing mode and test taking strategies on students' performance on computer-based tests, and in comparison with paper-based tests (Al-Amri, 2007).

Table 1 below, indicates that more than half of the participants developed a positive attitude towards the majority of CBT features. For instance, it was easier for 51% of the subjects to navigate through the passages on computer than on paper and 43% found it easier to read the test items on the computer than on paper. Moreover, about 55% felt it less fatiguing to take a test on computer than on paper. Fifty-seven percent and 90% respectively found recording and changing the answers easier on computer. Not only that but also 50% of the subjects felt more comfortable when taking the test on computer than on paper and 76% enjoyed it (Al-Amri, 2007, pp. 107-108).

Table 1
Student Attitudes about Assessment Study Results (Al-Amri, 2007, p. 108)

Questions	N= 167 Options		
	On paper	No Difference	On computer
In which test was it easier to record answers?	39	32	96
In which test was it easier to change answers?	9	7	151
Which test were you more likely to guess the answer in?	29	88	50
Which test was more comfortable tp take?	63	20	84
In which test would you be more likely to receive the same score if you took it a second time?	52	70	45
Which test was more enjoyable to take?	20	20	127
Which test more accurately measured your reading comprehension skills?	85	44	38

Why Use Computer Based Tests

According to Davey, there are three basic reasons for testing via computer. The first is to enable measurement of constructs or skills that cannot be fully or appropriately captured by paper-based tests. The second is to improve measurement by increasing the precision or efficiency of the measurement process. The third is to make test administration more convenient for examinees, test sponsors, or both (Davey, 2011, pp. 1-12). Perhaps the largest impact on instructors or teachers is the third reason which includes operational convenience for students, test administrators, and those who use test scores (Davey, 2011, p. 3).

According to Ray, another advantage of implementing CBT in the classroom is that the grading is done by the computer and therefore there is no grading load. Another advantage of CBT is that it provides the instructor additional options in designing the tests that are not possible in paper based tests, for example, a dynamic difficulty level of questions. This is seen in adaptive test formats similar to Measure of Academic Progress-Science (MAPS) assessments. The disadvantage is that CBT is useful as far as grading is concerned, but only for objective questions (i.e., where the answers do not depend on the subjective view point of the student) (Ray, 2008). These subjective response questions can still be included, but the instructor would be responsible for grading these individual responses.

Computer-Adaptive Tests

Wainer, Doran, Eignor, Flaugher, Green, Mislevy et al. (2000) suggest that computer adaptive tests are more responsive to individual needs. An adaptive test adjusts to individual differences by presenting a question to the examinee within a specified ability range. If the examinee answers the question correctly, the next question asked is more difficult. If the examinee answers incorrectly, then the subsequent questions become easier until a proficiency level has been established within a specified level. This method of assessment is given as an individual test, but can be administered to multiple examinees during a single testing session since this type assessment is available online using computers, tablets, or other technology.

Northwest Evaluation Association (NWEA) utilizes an online test bank that offers questions at a wide variety of academic levels called the Measure of Academic Progress – Science or MAPS. MAPS is a computer adaptive test that improves student engagement

by challenging the high achieving students, while still lowering frustration levels of lower-archiving students. Computer Adaptive Tests like MAPS allow teachers to measure individual student growth longitudinally while providing immediate results that could impact instruction (DeLong, 2007, pp. 22-23). Using a reliable and valid assessment tool in classrooms allows teachers and administrators the ability to make data driven decisions which will drive instruction and the educational outcome for students. In the current climate of high-stakes testing, this is valuable information to have.

METHODOLOGY

Introduction

The overall purpose of this action research project was to make a comparison between student achievements and attitudes on computer-based assessment versus a traditional paper/pencil assessment as well as their effects on me as the teacher. Conducting this study will impact and improve my teaching through obtaining a better understanding of the best assessment practices for both my current and future students.

The study closely examines the effects of computer based assessment versus the traditional paper-pencil assessment on student scores and student attitudes, as well as the advantages and disadvantages of each mode of assessment and the impact of the treatment on me as a teacher.

The implementation of the treatment—computer-based assessment- followed a training period involving the use of specific technology and applications including iPads, Google Drive, and Google Forms in the classroom setting. The process ensured a comfort level needed for students to use the technology in the classroom successfully during this treatment. This level of comfort was confirmed by providing students with

opportunities to practice using the components Google Drive and Google Forms before assessments were given in an exploratory environment and checking with students informally to make sure that they were comfortable with using technology. Explicit instruction was also provided at the time of assessment by me as the instructor, and students were able to ask questions of me or their peers as needed.

Treatment

The data collection period took place throughout the first three quarters of our school year, each quarter lasting nine weeks. The first non-treatment period began on the first day of school and lasted throughout the first unit of instruction, which was approximately six weeks and covered reporting category 1 for our state assessment—"Matter and Energy." This non-treatment began with me completing the Grasha-Riechmann teaching style survey to establish baseline data on myself so that I would be able to see if there was an effect on me as a teacher as a result of the treatment. The students also established a baseline after taking a student technology use survey. Throughout the unit I recorded my thoughts using active participant observation via a teaching journal. Student interviews were conducted recorded and transcribed using an iPad for easy reference and student surveys were given using a Likert scale as well as probing questions using a Google Forms document on the iPads.

This same procedure as outlined above would be duplicated during the treatment period beginning in the second unit of instruction, covering reporting category 2 for our state assessment—"Force, Motion and Energy." The treatment period included the implementation of the computer-based assessment including MAPS software as a placement test and assessments using Google Forms in place of paper/pencil tests. This

cycle of non-treatment and treatment was replicated twice during the data collection period as to include a non-treatment, treatment, non-treatment, and treatment period for a total of four units of instruction. At the end of the data collection period the Grasha-Reichmann teaching style survey was completed again to compare initial results to final results so that any impact the different styles of assessment had on me as a teacher and my personal teaching style would be indicated. Table 2 below, outlines the treatment and non-treatment cycles that were implemented, which includes a timeline, unit, objectives, and data collected.

Table 2
Treatment and Non-Treatment Cycles

Length of Instruction	**Unit Title**	**Objectives Taught**	**Type of Treatment**	**Data Collected**
8 Weeks Aug. 26-Oct4.	Matter and Energy	• Physical Properties of Matter • Properties of Water • Mixtures and Solutions • Separating mixtures and solutions using physical properties	Pre-Treatment (PPT)	• Grasha-Riechmann teaching style survey • Student technology use survey • Active participant observation • Student interviews • Student attitude survey • Traditional paper-pencil assessment
8 Weeks Oct. 7-Nov.22	Force, Motion and Energy	• Circuits and Electricity • Forms of Energy and their transformations • Light and Sound • Changes in Force produce motion	Treatment (CBT)	• Active participant observation • Student interviews • MAPS Software Placement Test (Fall) • Computer-based assessment using Google Forms
6 Weeks Dec. 2-Jan.17	Changes in the Earth	• Formation of Fossil Fuels • Changes to the Land • Alternative Energy • What Happened Before	Pre-Treatment (PPT)	• active participant observation • Student interviews • Traditional paper-pencil assessment
6 Weeks Jan. 20-Feb.28	The Earth, Moon, and Sun	• Weather and Climate • The Sun and Water Cycle • Earth's Rotation • Earth, Sun and Moon	Treatment (CBT)	• Active participant observation • Student interviews • Student attitude survey • MAPS Software Placement Test (Winter) • Computer-based assessment using Google Forms • Grasha-Riechmann teaching style survey

The treatment instruments used for each of the two treatment cycles include a teacher created test that is administered to students using the Google Forms application and a computer adaptive assessment using the Measure of Academic Progress – Science (MAPS).

Every effort was made to ensure that the first cycle of pre-treatment and treatment units and instruction were comparable in depth and complexity as well as the length of unit instruction. The same process was used for the second cycle of pre-treatment and treatment units. In future classes, it may be beneficial to alternate between CBT and PPT for individual objectives as concept attainment quizzes rather than for reporting categories as unit tests. This would allow smaller chunks of information to be assessed and it would be easier to compare objectives of similar difficulty.

For the first cycle, a baseline non-treatment was established. Students were instructed using routine methods during the unit "Matter and Energy." At the end of the unit a traditional paper-pencil unit assessment was administered. The second part of this first cycle included routine methods of instruction during the "Force, Motion and Energy" unit. At the end of this unit, the treatment method was applied. Students were administered a unit assessment that was comparable in length and difficulty to the pre-treatment assessment, with the exception that it was given as a computer based assessment using Google Forms as the program used to deliver it to students.

For the second cycle of treatment, the third unit of instruction, "Changes in the Earth," included routine instruction followed by a unit assessment administered using a traditional paper and pencil format. The fourth unit of instruction covering subjects within the unit "The Earth, Moon, and Sun" was presented using routine methods of

instruction. The unit assessment was comparable in length and difficulty to the pre-treatment assessment, with the exception that it was given as a computer based assessment using Google Forms as the program used to deliver it to students. The scores from each assessment were recorded and were compared.

When using Google Forms, a user uses the application to insert different types of questions or stems by choosing item types from drop down menus and then designating possible answer choices if applicable. Users are able to choose the destination of responses in a spreadsheet and can even run scripts that will grade the student responses. The PPT were multiple-choice assessments with one to two grid-able numerical responses. The CBT designed in Google Forms were also presented in multiple-choice format and the one to two numerical calculation response questions were formatted as text submissions.

The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix A).

Methods of Data Collection and Data Analysis

The methods of data collection and analysis are displayed below in Table 3 and then discussed briefly.

Table 3
Data Triangulation Matrix

Research Questions	**Data Sources**		
	1	**2**	**3**
How is student achievement on assessments impacted by the use of computer-based tests?	Unit Test Scores	MAPS Science Assessment	Active Participant Observation Journal
What are the advantages/disadvantages to computer based testing?	Student Attitudes about Assessment Survey	Student Technology Use Survey	Active Participant Observation Journal
How are student attitudes about assessment affected by the use of computers during assessment compared to traditional paper pencil tests?	Student Attitude Survey (Likert Scale)	Student Interviews	Active Participant Observation Journal
What are the effects of computer based tests on me as a classroom teacher?	Active Participant Observation Journal	Grasha-Riechmann teaching style survey (2 times)	Unit Test Scores

The four questions asked during this study required a variety of data collection methods to adequately draw a conclusion based on those findings. The first question asked about student achievement on assessments being impacted by computer-based tests (CBT). This question required the collection of pre-treatment unit test scores using traditional paper-pencil tests (PPT) as well as the collection of unit test scores during treatment cycles using CBT. In addition to unit test scores, an online, adaptive test was piloted with the 5th grade students. Northwest Evaluation Association accepted a proposal for use of the MAP Science program for research purposes. "NWEA Measures of Academic Progress (MAP) tests present students with engaging, age-appropriate content. As a student responds to questions, the test responds to the student, adjusting up or down in difficulty."(Northwest Evaluation Association, 2013). This nationally recognized, research based assessment allows students to show growth by using

individualized and adaptive CBT data to monitor student achievement longitudinally. Adaptive CBTs can be more efficient than conventional tests that present the same items to every student. It is not uncommon for an adaptive test to match the precision of a conventional test containing 25% more items. Conversely, an adaptive CBT can match the length of a conventional test but return more precise measurement, particularly of the students at either extreme of the performance continuum (Davey, 2011).

As an instructor, I also kept an active participant journal with observations made throughout the treatment and non-treatment cycles regarding student achievement on CBTs.

The second and third questions of this action research project concentrate on the advantages and disadvantages to computer based testing and student attitudes about assessments, specifically computer based and paper-pencil. The data for these questions focused on a student technology use survey to gauge student comfort by collecting data based on student responses on a technology use inventory as seen in Appendix B, a student attitude survey using a Likert scale as seen in Appendix B, as well as student interviews using a student sample group comprised of one student from each quintile group identified using unit test scores.

Student responses for both surveys mentioned above were analyzed, sorted, and grouped by similar trends. Patterns and trends were easy to see based on student comfort levels of technology use outside of school. Responses were then analyzed based on responses to the Likert scale responses by grouping answers that fall between the ranges of 1-2, 3, and 4-5. These ratings will correlate to student groups identified as low comfort, medium level comfort, or high comfort with technology. This data was useful

when comparing computer based assessment scores to student's corresponding comfort levels to observe if there is a correlation between comfort level with technology use and assessment scores as compared to traditional paper pencil assessment scores.

Student responses to attitude questions were designated a corresponding number: strongly agree will be "5," agree will be "4," not sure will be "3," disagree will be "2," and strongly disagree will be a "1." The data from this survey was compared to data collected from the technology use survey to see if students who were classified as low, mid, or high comfort levels had similar responses on the attitude survey as well. This attitude survey was administered as both a pre- and post- survey, once before and once after the treatment and non-treatment cycles were complete.

The interview process for each treatment and non-treatment cycle occurred after each unit test is administered. After assessments are scored, students were chosen at random from each of the five quintile categories. This was done to ensure that student responses were collected from students who were successful and not successful as well as students who fall somewhere in between. Further interviews and analysis were done for students who show drastically different results on the different assessment methods.

The last question presented as part of this study pertains to the effects of computer based testing on me as a classroom teacher. This question is important to the implication of different assessment methods to my personal teaching style. For this reason, the Grasha-Reichman Survey was taken as both a pre and post survey at the beginning of the first non-treatment cycle and again at the end of the second treatment cycle. This showed the effect of the different assessment modes and whether my personal outlook of my teaching style changed. I also used the information recorded in an active participant

journal and a reflection of my student's unit test scores during treatment and non-treatment cycles to reveal quantitative implications on my assessment practices. Throughout my non-treatment and treatment cycles, I focused on some key areas including: student/computer ratio, software application, technology users, hardware issues, software issues, network issues, length of time needed for students to complete tests, and other comments. These comments were then organized into a table and patterns and similarities were identified.

The methods selected for this study provided adequate triangulation because they involved three sets of participants, (me as the teacher, students across six class periods, and students identified in student interviews) and two methods of collecting data (quantitative and qualitative) were utilized. Published instruments, including the Grasha-Reichman Teaching Style Survey and MAP-Science, were used as well as triangulation of multiple instruments helped insure the validity and reliability of the data collected. Validity and reliability for the data collection methods were obtained by working closely with my supervisor, Dr. Walt Woolbaugh, as well as conducting peer reviews from other MSSE students before student surveys were administered.

Limitations

Using a survey to sample the population has its limitation. Some surveys may not be completed due to student absences or to an increased number of student absences due to inclement weather, therefore there is not a 100 percent return rate when working with minors. Another limitation of this study is that although every effort was made to ensure that content for each treatment period was of similar difficulty and interest for the students, it was not possible to ensure one hundred percent equality of difficulty and

interest level between treatment and non-treatment cycles. The difficulty level of the different assessments (PPT and CBT) cannot be quantified, as they are teacher created. Controlling item difficulty on assessments with varying content is not an exact science and the teachers constructing these test items are not professional item writers. An additional limitation deals with the age of students included in this study. Fifth grade students range in age from 10-12 years in age. This age group of students begin going through puberty and deal with a multitude of hormonal changes affecting their moods causing them to respond one way one day and a different way the next day. Also, students do not all have the same amount of familiarity or proficiency using computer applications. There is no way to ensure that students begin with exactly the same computer experience. Regardless of the limitations that were present during this study, the information that was gained will be used to influence future assessment and instruction.

DATA AND ANALYSIS

To answer each question, I will provide data and analysis for each of my questions using a data triangulation method.

1. How is student achievement on assessments impacted by the use of computer-based tests?

The data sources collected to answer this question include unit test scores from two non-treatment and treatment cycles, MAP-Science Adaptive Assessment, and an active participant observation journal completed by me.

The first data source that was considered was unit test scores from two non-treatment and treatment cycles. Student scores with incomplete data due to “no-score”

reasons which could vary from being pulled for testing or being absent due to illness or other reason were removed. This brought the sample size to N=101. Scores were then separated into category titles “Cycle 1” and “Cycle 2,” each comprising of a non-treatment baseline (PPT) and treatment cycle (CBT). The percent change was calculated and shown on a table as either a positive change or negative change for each cycle. The average percent change was calculated for the entire sample size for both cycles. From this data, the following figure was created.

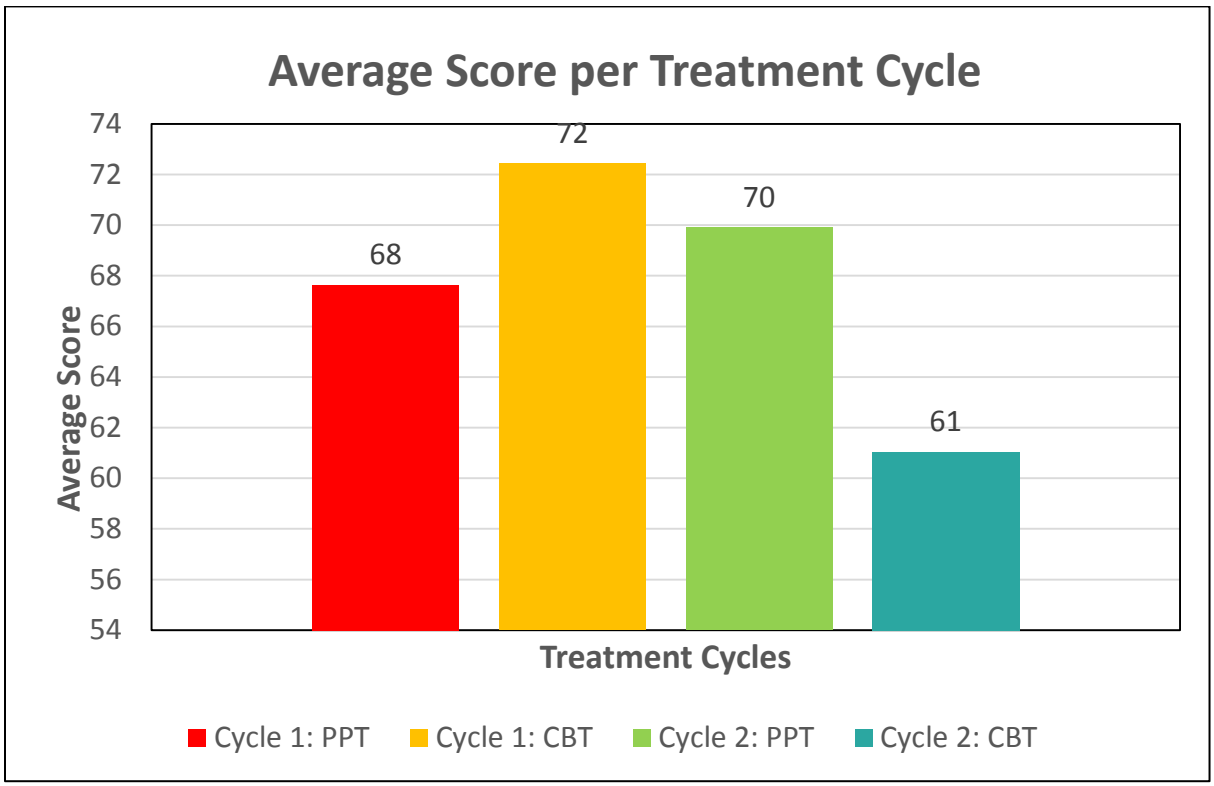

Figure 1: Average Score per Treatment Cycle, (N=101).

The mean percent change for cycle 1 was an increase of 8% while the mean percent change for cycle 2 was a decrease of 11%. The calculated average percent change for both cycles overall was -1.60%. This showed a slightly negative impact of the treatment (CBT.)

The decrease in the second treatment cycle might be attributed to the abnormal winter that we experienced this past year. The East-Texas region does not typically experience significant snow events. Due to this year's "Polar Vortex" that we experienced, we had one snow day and several late starts. This resulted in a less cohesive Earth Science Unit. Students did not get uninterrupted instruction. We missed school for Thanksgiving break, Christmas break, and the previously mentioned snow events. This caused the unit to become choppy and less cohesive. I believe that this had an effect on the students' assessment data for this unit.

The data collected from the MAPS adaptive computer assessment supports the data collected from the unit tests during both treatment cycles. The Rasch unit (RIT) stands for a unit of measure that uses individual item difficulty values to estimate student achievement. The RIT score from the Fall and Winter MAPS test was used to calculate the percent change.

> The RIT Scale is a curriculum scale that uses individual item difficulty values to estimate student achievement. An advantage of the RIT scale is that it can relate the numbers on the scale directly to the difficulty of items on the tests. In addition, the RIT scale is an equal interval scale. Equal interval means that the difference between scores is the same regardless of whether a student is at the top, bottom, or middle of the RIT scale, and it has the same meaning regardless of grade level (NWEA, 2014, p.1).

Student scores with incomplete data due to "no-score" reasons which could vary from being pulled for testing or being absent due to illness or other reason were removed from

the sample. This brought the sample size to N=101. Scores were then separated into category titles “Fall RIT” and “Winter RIT.” The percent change was calculated from the Fall RIT to the Winter RIT. From the individual percent change for each student an overall mean percent change of the RIT score was calculated for the entire sample size which equaled 0.8%. This supports the hypothesis that student achievement is positively impacted by the treatment (CBT.)

Table 4
Student Achievement t-test Comparison, (N=101)

		MEAN	STANDARD DEVIATION	STANDARD ERROR	P-VALUE
CYCLE 1	PPT	67.64	14.55	1.45	0.01161
	CBT	72.44	15.07	1.51	
CYCLE 2	PPT	69.91	19.82	1.98	0.0006
	CBT	61.04	18.08	1.82	
MAPS	Fall RIT	203.96	9.32	0.93	0.10245
	Winter RIT	205.62	9.14	0.914	

When looking at treatment Cycle 1, Cycle 2, and the MAPS scores a t-test was done on the student data N=101. The calculations can be seen in Table 4 above. In Cycle 1, the mean score for the CBT, 72.44% was higher than the mean for the PPT meaning that students had a higher achievement on the CBT when compared to the PPT. The standard deviation for the PPT was less than the CBT though, which means that there was slightly less variability in student scores using the PPT when compared to the CBT. Conversely, for Cycle 2, the student mean score for the PPT was higher than the CBT. Students had higher achievement on the PPT when compared to the CBT. According to the p-value of cycle 2, 0.0006%, this result shows that the results were statistically

significant and not by chance when compared to the standard p-value of .05%. The significance of these results may be related to the weather events mentioned previously in relation to the choppiness of the instruction prior to the unit assessment. When looking at the MAPS scores longitudinally, the mean RIT score increased 1.66%, while the standard deviation decreased slightly with a -0.18 change.

Overall, the data suggests that student achievement on teacher-generated computer based tests is impacted in a slightly negative way. On the other hand, norm-referenced adaptive CBT increase student achievement. This data is very interesting when taken into consideration with student perception and attitude toward assessment.

This difference in results is possibly due to the fact that students enjoy using technology and prefer that method compared to PPT options. Even if students do not have an increased achievement, they still prefer that method.

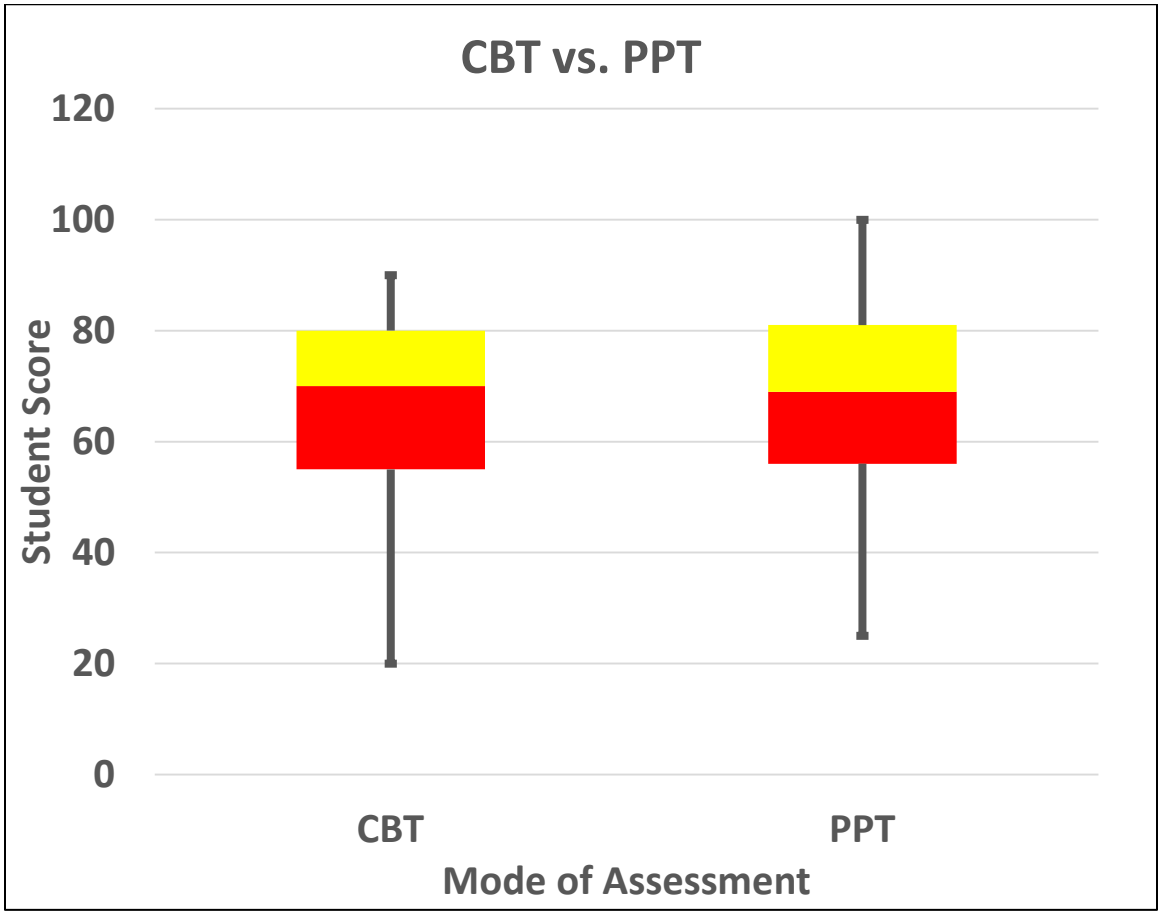

Figure 2. CBT vs PPT Scores, (N=202).

Figure 2a and 2b show a comparison of all student scores on CBT and PPT N=202. For the two CBT, the median score was 70 with the minimum score being 20 and the maximum score being 90. The first quartile began at 55 and the third quartile ended at 80. The interquartile range was 25. There were seven outliers for this data set with scores of 20, 25, 25, 25, 28, 30 and 30. For the two PPT, illustrated in figure 2b, the median score was 69 with the minimum score being 25 and the maximum score being 100. The first quartile began at 56 and the third quartile ended at 81. The interquartile range was 25. There were five outliers with scores of 25, 31, 31, 31, and 31. This data suggests that students will score similarly on either CBT or PPT since the median score

was almost the same and both assessments had the same interquartile range. Students seem to have a better rate of success on PPT though since both the minimum and maximum score were higher when compared to the CBT. Interestingly, when the outlier scores were compared from each assessment four of the scores from each assessment method were the same. This indicates that these students are not successful on either type of assessment.

One interesting segment of data to consider are students whose achievement was not affected by either type of assessment. Of the 135 students who I was able to collect data on, 17 of them showed no positive growth or achievement on any type of assessment: CBT, PPT, or Computer Adaptive Test. Of those 17 students, 15 of them are considered to be "at-risk." There are 64 students identified as "at-risk" in the sample of students included in this project. This shows that 23% of students who are considered at risk showed no increased achievement on assessments regardless of mode. This information is eye-opening and leads me to believe that for some at-risk students, the mode of assessment is not important, but the mode of instruction should be evaluated and adjusted for these students and additional interventions may be needed.

2. What are the advantages/disadvantages to computer based testing?

The data sources collected to answer this question include a Student Attitudes about Assessment Survey (Appendix B), Student Technology Use Survey (Appendix C), and an active participant observation journal (Appendix D) completed by me as the course instructor.

At the beginning of this action research project, it was important to conduct a student technology use survey to establish a baseline to act as a reference point to find out what type of technology students had access to outside of school and to find out how they utilize that technology on their own. In figure 3, you can see that students had a variety of technology devices in their possession or available to them to use at home, some even had multiple technology devices at their disposal. Of the 114 students who completed this survey, zero students who responded to the survey indicated that they had no access at home or available to them outside of school.

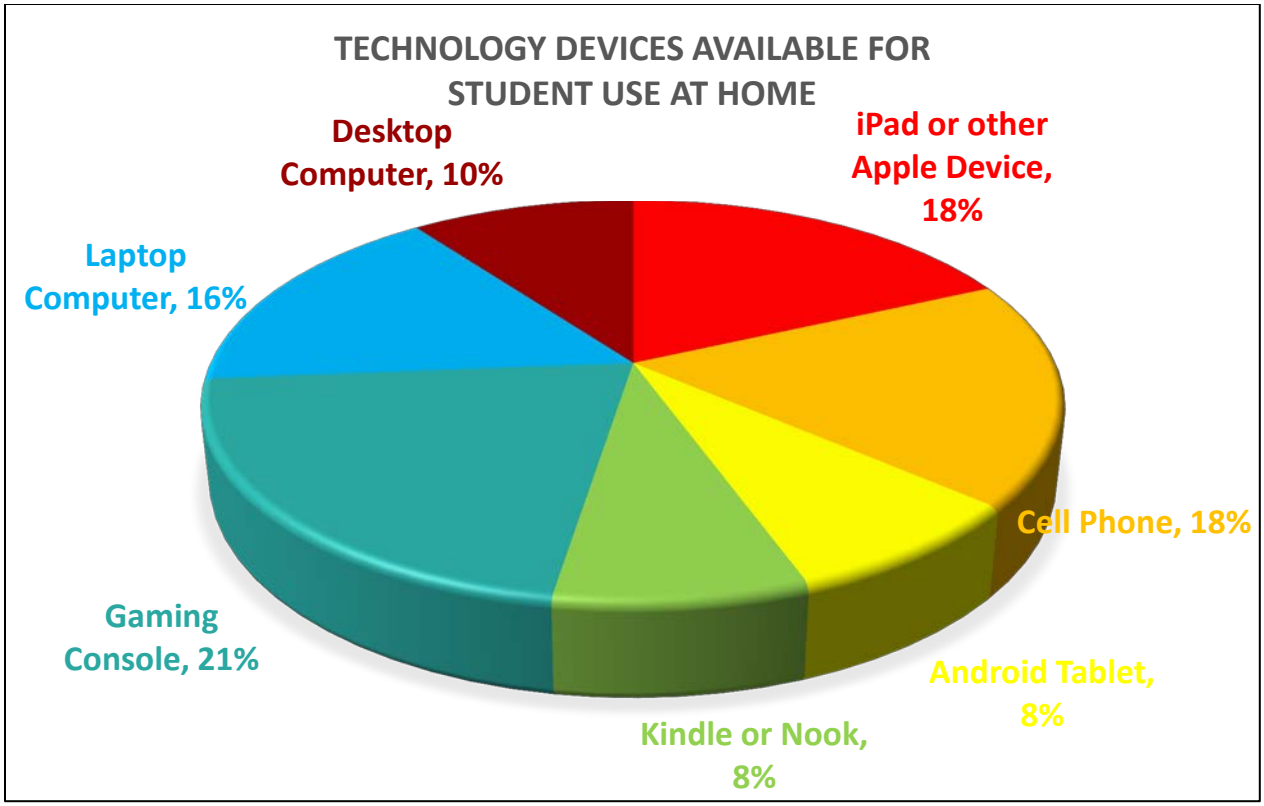

Figure 2. Technology Devices Available for Student Use at Home, (N=101*)*.

The student technology use survey was an important instrument to find out how students have previously used their available technology at home to access various

information and establish a baseline to determine their overall level of experience. As seen in figure 4 below, I found the contrast in student use of the internet for entertainment versus using the internet for academic websites to be very interesting, although predictable. The results of the post technology use survey were consistent with the results collected in the survey conducted at the beginning of the first treatment cycle, and did not change during the course of this treatment.

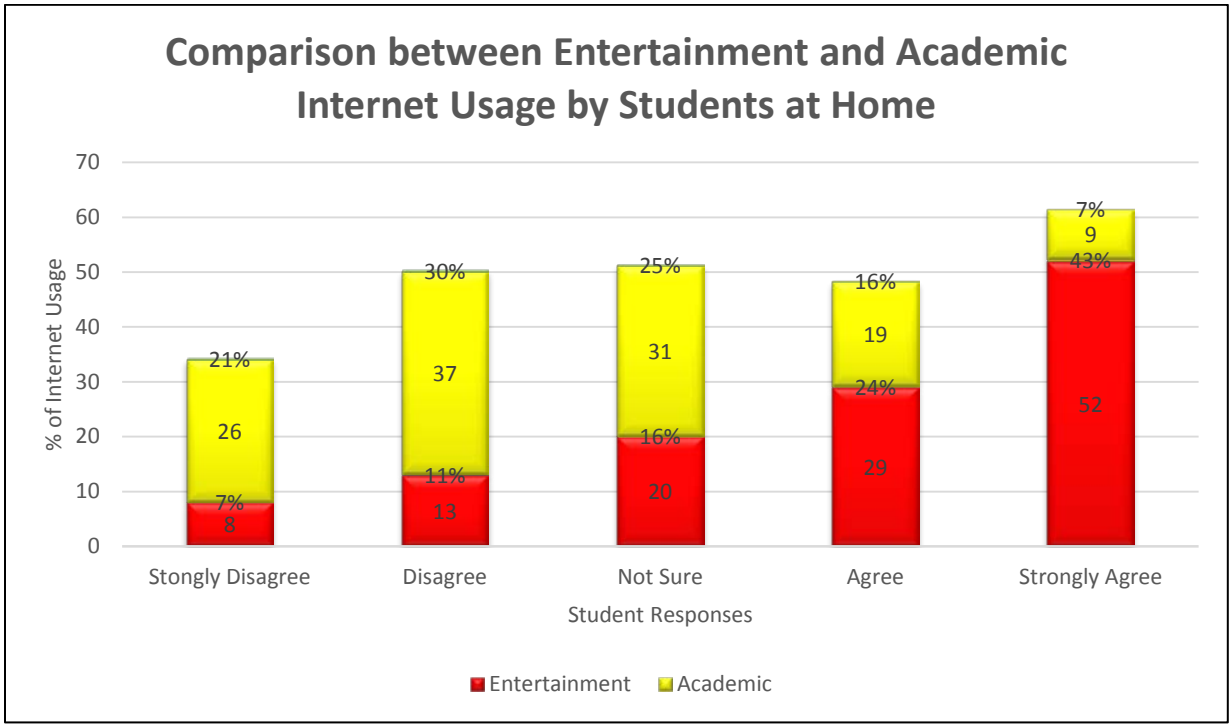

Figure 4. Comparison between Entertainment and Academic Internet Usage by Students at Home, (N=101).

According to the student responses, 43% of the students strongly agree with accessing the internet at home for entertainment. This data sharply contrasts that only 7% of students who access the internet for academic websites. In fact, the average time spent with screen media among 8-18 year olds is more than twice the average amount to time spent in school each year (Kaiser Family Foundation, 2010; National Center for

Education Statistics, 2007-2008). The average 5th grade student is 10-11 years old, so this statistic is very applicable to my current students, and the amount of time may have even increased as six years has passed since these statistics were published. Regardless of what content students are accessing at home, I received confirmation that they have experience utilizing the internet and should be able to transfer that experience to the classroom for instructional and assessment purposes, which is a definite advantage for using it in the classroom. I would hypothesize that since students have such a high interest in media usage, that presenting assessment opportunities would increase student achievement. This hypothesis was confirmed by a post-treatment survey question (Appendix E) that was posed to students. Students were asked, "If you were able to choose how you are assessed in class, which would you choose?" In that survey (N=122), 108 or 89% of students responded that they would choose using a tablet or computer while only 14 or 11% of students responded that they would choose a traditional paper and pencil assessment. Students were then asked, "Which method of assessment do you feel most successful at?" The results were almost identical with 86% of students reporting that they feel most successful at CBT, while 14% of students feel most successful at PPT. When the specific data was filtered, one of the students who felt most successful using paper and pencil to test made the comment, "I feel it is good because if I need to work it out on a paper, but sometimes I do not because sometimes I will get bored and guess on it." On the other hand, four students mentioned that they felt most successful at CBT because they feel more focused and less distracted. The most reported benefit for CBT was that the students' hands' hurt less. This was mentioned 18 times. Based on the majority of student responses, 86% of the students see using CBT as

an advantage based on their feelings of success in the classroom. The majority of students perceived CBT as an advantage when compared to PPT, which is significant because positive self-perception may correlate to higher achievement on CBT if it studied over a longer period of time.

This information collected during the technology use survey indicated a definite advantage to using computer based testing for the reasons that they are familiar with the technology necessary to utilize computer based testing in the classroom and also as a possible extension of computer based testing to allow a "flipped classroom experience" which is an idea that I am interested in implementing as a result of this research.

Using my active participant journal (Appendix C) that was kept throughout the course of the non-treatment (PPT) and treatment (CBT) cycles was very informative in identifying some specific advantages and disadvantages of using computer based assessment. The negative comments that I made regarding the first treatment cycle CBT were specific software or network issues that may or may not be encountered in other school settings. I mentioned, "After 6 class periods, I was very frustrated. I had to set up 24 iPads with Google Drive." This was a definite disadvantage as it was very time consuming. One good thing about this is that once it was done, I never had to do it again. The initial investment of time for this was approximately three hours. This was used to install Google Drive and sign in to the account that was created for students to access various assessments. This up-front investment in time was worth it to me when I took into consideration the amount of time that would be spent grading tests by hand versus utilizing the Google Form application and the automatic grading script "Flubaroo" doing it for me. Another comment that I mentioned was, "the Intermediate campus that I work

at had filters up that would not allow Google Drive access on iPads for students. I had to have my principal give permission to the district IT director to remove those filters. This was fixed quickly, but was still an issue." This network issue was something that I could not control. I did have to get specific permission from my principal and have an email come from her to the IT director in order to follow the chain of command for the filters to be removed. This type of consideration must be made well in advance of any type of computer based assessment occurring in a classroom. It would have been a mistake to think that everything would work flawlessly the first time that the treatment was implemented, and although there were some disadvantages for me as the teacher and facilitator, the students did not experience them. There were some additional comments that I recorded that did impact students directly. "Students took between 30-45 minutes to complete this test." This was an advantage because students finished in one class period instead of it being drawn out into two class periods like the non-treatment during both cycles. Another advantage was that I had student scores immediately, and I did not have to hand grade anything. Although, with PPT, I was not required to hand grade, I did have to wait until an administrator ran scantrons through a machine to grade them and then I had to access them and select specific reports for my students. There was a lot more "work" involved in getting scores for the PPT versus the CBT. Another comment that was made was, "it was much easier for students who were absent to make up this test. Students did not miss more class time to make up the test. It could be assigned to be completed at home." Students were able to grab an iPad to test during PE or music time and were finished that same day. I did not feel like students missed as much class time to make up the test using the iPads compared to PPT, which took twice as long to complete.

This discrepancy in amount of time it took students to complete the two assessments may be due to the test taking strategies that students have been taught since 3rd grade. Students are expected to use these strategies on all assessments. Students were not able to complete these strategies on the iPads, which resulted in the CBT to require half the time.

Overall, the advantages outweighed the disadvantages. The majority of the hardware or network issues that I experienced were only frustrating to me and did not affect the students. The issues were fixed quickly and did not hinder students from completing assessments. I will definitely continue to allow students to be assessed using iPads. In the future, it might be beneficial to give students the choice in their personal mode of assessment and provide both modes. If I offer the assessment on the computer, it would not be any extra work to print it out for the students that choose PPT as their preferred method.

3. How are student attitudes about assessment affected by the use of computers during assessment compared to traditional paper pencil tests?

The data sources collected to answer this question include a Student Attitude Survey (Appendix C), Student Interviews, and an active participant observation journal completed by me (Appendix F).

The next segment of data collected and analyzed included a pre- and post- survey regarding student attitudes about assessment. Students answered Likert-style survey questions (Appendix C) about their personal feelings about assessment.

As students completed the student attitude survey, their responses were automatically recorded in a spreadsheet. Student responses were then sorted, and

grouped by similar trends. This attitude survey allowed student responses to be grouped in several different ways to analyze the data by utilizing the 'filter' function in the Excel program.

I grouped students by their perception of their usual science grades and look for trends in responses as well as specifically looking at students' free form responses to work backwards to see if there are similar responses that have other correlations. Student responses to attitude questions were designated a corresponding number for easier disaggregation: strongly agree will be "5," agree will be "4," not sure will be "3," disagree will be "2," and strongly disagree will be a "1." The data from this survey was compared to data collected from the technology use survey to see if students who were classified as low, mid, or high comfort levels had similar responses on the attitude survey as well. This attitude survey was administered as a pre-survey and a post- survey--once before and once after the treatment and non-treatment cycles were complete.

Each student N=114 filled out a survey in class. The data was put into a Google spreadsheet and this graph was generated (see figure 5).

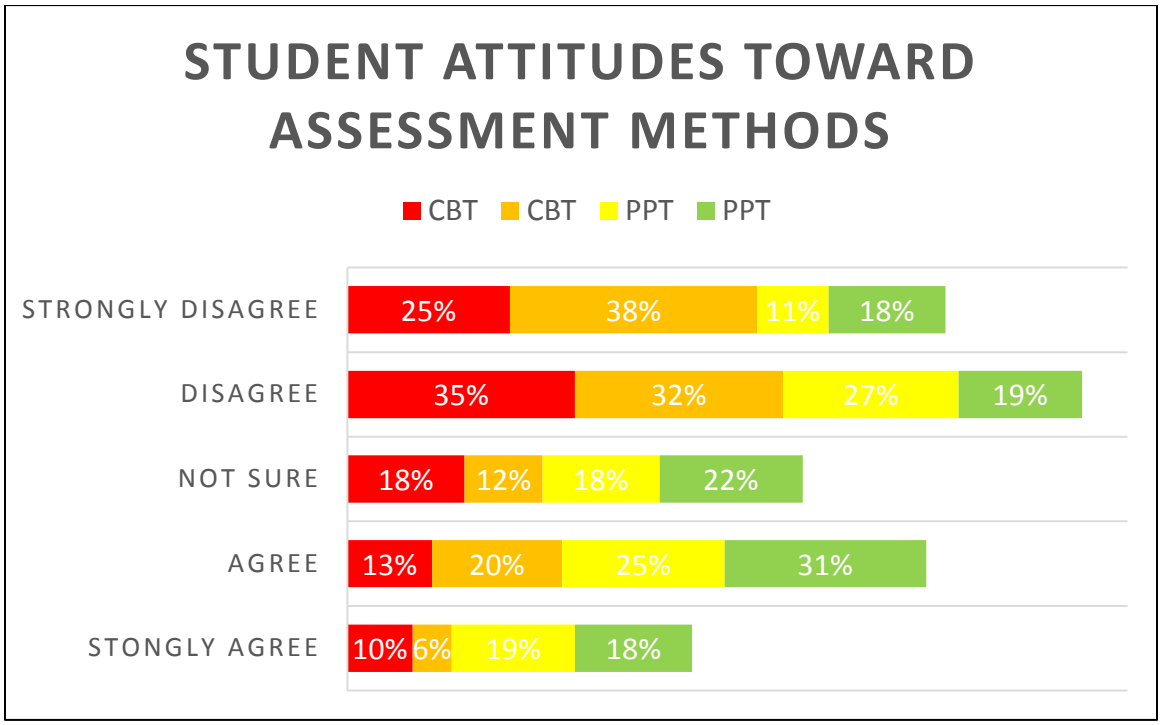

Figure 5. Student Attitudes toward Assessment Methods, (N=114)

During the Student Attitude about Assessment Survey, students were asked to designate a response to the following statements: "I feel nervous when I have to take a test on the computer in any subject," and "I feel nervous when I have to take a test using paper and pencil in any class." The responses were strongly agree, agree, not sure, disagree, and strongly disagree.

According to a study completed by J.C. Cassady, 25-40% of students report feeling test anxiety (Cassady, 2010). In relation to Figure 5 above, it is important to point out that 26 students, approximately 22% of students responding to this survey, answered that they either agree or strongly agree to being nervous about testing on a computer.

Alternately, 50 students, about 44%, report feeling nervous about testing using traditional paper and pencil methods. According to the analytics that were run by Google Forms on the student responses, 11% of the students reported feeling nervous for both computer and paper-pencil assessment. I would hypothesize that these students have some extent of test anxiety regardless of format, either traditional paper/pencil or computer-based. When I looked further at these 13 students' free responses to the probing question "Why do you like/dislike taking tests using a paper/pencil" the most common response that I found was some variation of "dislike, because it hurts my fingers/hand" or "I get more worried and I lose focus" and "I get nervous." Even though they answered that they did not like tests regardless of their format, the majority, 70%, of them did not list anxiety as the reason they did not like traditional paper/pencil test.

4. What are the effects of computer based tests on me as a classroom teacher?

The data sources collected to answer this question include an active participant observation journal completed by me, the Grasha-Riechmann teaching style survey (Appendix D) and Unit Test Scores.

According to the Grasha-Riechmann Teaching Style Survey (Appendix D) my personal teaching style was not affected in the first four styles of teaching, but the last style, the delegator, increased by 21%. I believe that the style "Delegator" increased so much because, throughout the use of technology for assessment, I saw the benefit for increased use during instruction. As a direct result to this study, I incorporated a "flipped" approach to select units of instruction. Throughout this process I encouraged

the student's responsibility and allowed them to function autonomously in their learning path. The results to the survey are seen below in Table 5.

Table 5
Grasha-Riechmann Survey Results

	Expert	Formal Authority	Personal Model	Facilitator	Delegator
Pre-Treatment Survey	4.25	4.125	4.125	3.75	2.875
Post-Treatment Survey	4.25	4.125	4.125	3.75	3.625

According to Grasha's teaching style clusters, and the three highest scoring styles that I had in both pre- and post- treatment survey seen in the above table, I am a Personal Model/Expert/Formal Authority. Grasha mentions that these teachers "prefer role modeling, as well as coaching and guiding students. Primary learning styles that I am able to most effectively reach include participant, dependent, and collaborative" (Grasha, 1996, p.2).

The effects of the two treatment cycles can be seen by my comments in the last treatment and Winter RIT as seen in the Active Participant Journal (Appendix D). "This administration was easier for me as a facilitator. I did not have to help with opening the apps and getting students to open the right files. They already knew what to do. "This administration went very smoothly compared to the first one. Students seemed much more relaxed and knew what to do with the iPads and apps almost without being told." After the initial glitches in the beginning, students learned what was expected and how to

navigate the software better. They became more autonomous and felt more successful. I also become more comfortable with the technology and allowing students to utilize it.

Using MAPS data to guide instruction was very helpful and informative. NWEA offers various options for testing reports for students. One specific report that was used to analyze student achievement was the "Achievement Status and Growth Summary Report." A summary of the data presented for six class periods is compiled in the following table.

Table 6
Spring RIT Data (N=135)

	Mean RIT	Median RIT	Standard Deviation
Class 1	214.4	215	7.8
Class 2	207.6	208	11.7
Class 3	207.5	207	10.3
Class 4	207.7	209	5.7
Class 5	208.2	208	8.4
Class 6	209.8	210	7.9

The NWEA uses norm referenced data for comparison purposes. The Spring Mean RIT score for 5th grade students calculated by NWEA and its researchers is 205.3. In each of the six classes participating in this study, the students mean RIT score was between 2.2 and 9.1 points higher than the norm referenced score of 205.3. This data suggests that the use of computer based tests increases student achievement and that it should be continued to be used in the classroom setting.

In the Student Attitude about Assessment Survey (Appendix C) 70% of students

reported that they wished teachers used more technology in the classroom.

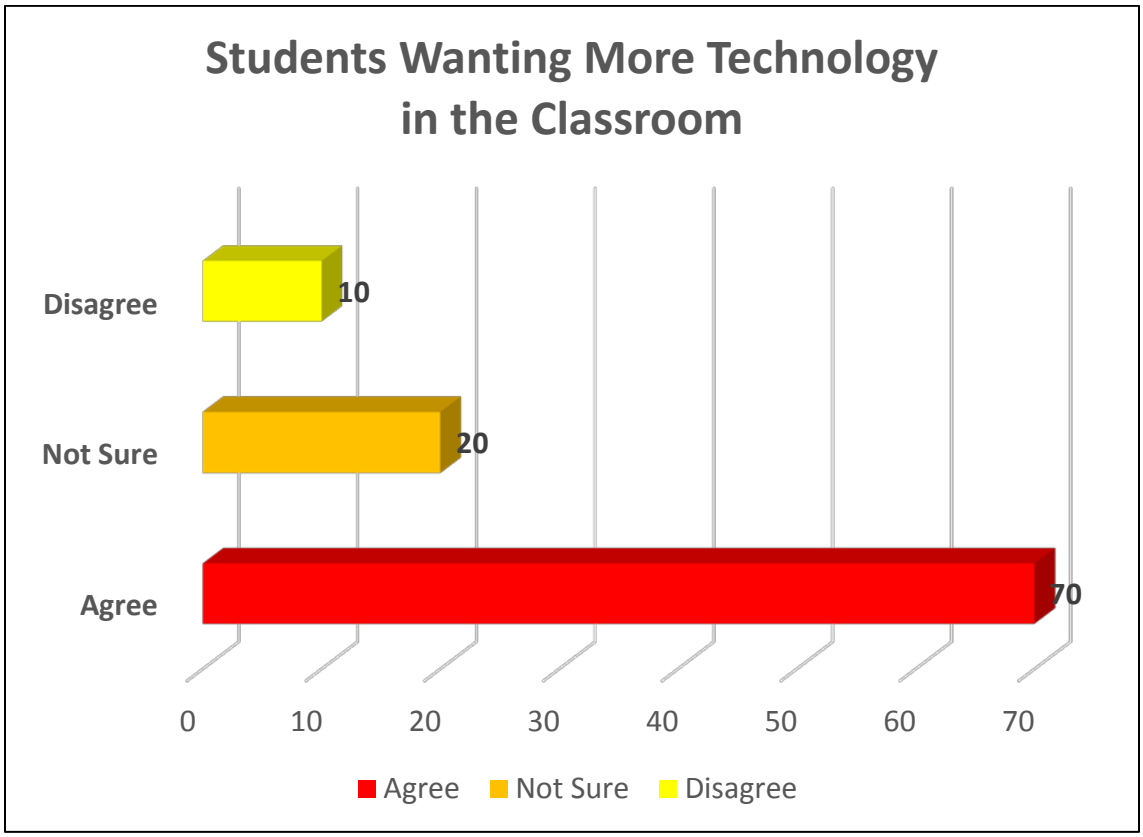

Figure 6. Students Wanting More Technology in the Classroom, (N=100).

Meeting student needs is an important aspect of teaching. With students using technology and media for entertainment, it seems like a natural evolution to encourage them to utilize it in the classroom as a learning tool. Knowing that students want to use more technology, I am affected in my choices in the presentation of content and mode of assessment to try and reach them.

Using my active participant journal to review my personal feelings and observations during this process while also looking at quantitative data helped to show the value computer based assessment to me as an instructor. The student scores were valuable to me as a teacher by helping me guide instruction for my students.

INTERPRETATION AND CONCLUSION

While evaluating different methods to incorporate the iPads in my classroom, I knew that students were already taking computer based assessments in their reading and math classroom and wanted to see how that could translate into the science classroom as well. I questioned what would have the most impact on my student's success on these assessments in my classroom. In this project, both the students and I benefited in some form or fashion. The students were allowed to test in a way that most of them preferred. They were able to see the value and benefit to the use of technology in the classroom. I was able to see that just like instruction; assessment is not one size fits all. I plan to continue the use of computer based testing for students in my classroom who show increased achievement with this assessment method. In this conclusion, I will address each of my focus questions for my research.

1. *How is student achievement on assessments impacted by the use of computer-based tests?*

Student achievement on assessments created by the teacher is neither positively nor negatively impacted by the use of computer based tests. The effect of either the treatment or non-treatment is neutral. This can be supported by looking at student unit test scores on unit tests. The data illustrated in figures 2a and 2b suggests that students will score similarly on either CBT or PPT since the median score was almost the same and both assessments had the same interquartile range. The calculated average percent change for both cycles overall was -1.60%. This showed a slightly negative impact of the treatment (CBT.) These results are countered by looking at the positive impact of the published adaptive instrument, MAP-Science. In each of the six classes participating in

this study, the students mean RIT score was between 2.2 and 9.1 points higher than the norm referenced score of 205.3. This data suggests that the use of computer based tests increases student achievement and that it should be continued to be used in the classroom setting.

The majority of students seemed to think that they performed better on computer based tests for various reasons, regardless of the actual outcome. This should be taken into account by teachers when trying to get student "buy-in" on assessments.

2. What are the advantages/disadvantages to computer based testing?

There are many advantages and disadvantages to computer based testing. One huge advantage that was evident, both in student attitudes toward assessment and student scores, was the level of interest and excitement in completing assessments by the students. Even though students showed an overall decrease in average scores by 1.6%, students still wanted to take tests on the iPad. To be honest, it is not often that you hear students ask a question like "Do we *get* to take a test on the iPad today?" I heard this exact question over and over again during my treatment periods. Students would also ask during non-treatment cycles when we could go back to testing on iPads.

A disadvantage of computer based assessments that occurred on more than one occasion during my treatment cycles was the fact that technology is not always reliable. I ran into wifi issues, network issues, and issues with not having enough technology devices for each student. These issues were frustrating to me as the teacher and also to my students. On one such occasion, multiple students had to resubmit their answers to a quiz multiple times because the network kept failing and losing connection to the district

wifi. I felt defeated because there wasn't anything that I could do to fix the problem and they were frustrated because some of them had taken the quiz three or more times. Should something like this happen in the future, there are some options that may be available to alleviate the frustration with having to retake the quiz multiple times. For example, the students could check to see if they were still connected to the wifi before hitting submit and if connection had been lost they could do a print-screen on the iPad and send it to me via email or print it out.

An important question that teachers have to ask before implementing CBT in their own classrooms is if the technology infrastructure of their school supports the use of technology in the classroom. Is there equipment for students? Is there support for the teacher? Does the teacher have an interest in using technology in the classroom? Is there internet connectivity? Do students have experience with technology outside of class? All of these are important questions that have to be answered by individual teachers in order to assess possible advantages and disadvantages of computer based assessment.

3. How are student attitudes about assessment affected by the use of computers during assessment compared to traditional paper pencil tests?

Student attitudes about assessment seemed to improve when using computer based assessment versus traditional paper pencil test. One example of this can be seen when one student put a note in my classroom mailbox saying, "I wish all teachers would let us take our tests on the iPads. Can you talk to them about it?"

Students showed more interest in class and were more engaged on days when instruction included technology. The same was true during the treatment cycles including CBT as the mode of assessment. The first treatment cycle showed that students

mean score was roughly 5% higher on the CBT. While on the second cycle, students mean score was roughly 8% lower on the CBT when compared to the PPT. This variation may be contributed to the fact that the content of instruction during treatment and non-treatment cycles is not identical. Variations are to be expected due to this limitation. Regardless of their actual scores on the assessments, 86% of students overwhelmingly would choose to be assessed using computers. Student attitude is a very important aspect to consider in regard to assessment and should be thought of when teachers are designing assessments.

4. What are the effects of computer based tests on me as a classroom teacher?

This survey was very affirming and supported my personal teaching style with data. Grasha points out some distinct advantages and disadvantages of this style of teaching. The advantages include focusing on clear expectations and acceptable ways of doing things, being "hands-on," and possessing knowledge and information to oversee, guide and direct learners. While these are definite advantages, there are also some drawbacks to this style of teaching. One disadvantage to being an expert is that underlying thought processes are not always shown. Managing learning and their concerns can be more rigid and less flexible for teachers who have a strong formal authority. The last disadvantage is probably the one that I feel has changed the most about me personally. Teachers who have a strong "Personal Model" can get stuck in their practice and believe that their way is the best way. I have to admit that I was one of those teachers. Like many teachers who have been teaching a while, I adopted the motto that "if it's not broken, why fix it." This action research project moved me past this stagnant way of thinking to a more forward thinking approach.

The effects of computer based tests on me as a classroom teacher can already be seen if you look in my classroom! I have seen such a positive response to the use of CBT in my classroom as part of my assessments that I wanted to investigate ways to include more technology in my instruction. One aspect of my classroom situation is the huge difference in the ability level of my students. I have students that range from having IQ's in mid to low 70's to students who are considered gifted. In a 50 minute class period I find it difficult to meet the needs of every student and challenge them on an appropriate level for their personal needs. The use of programs, like Edmodo, designed to "flip" a classroom seemed like a great way to meet everybody's needs, including my personal need to work smarter—not harder. I was able to assign work to students individually based on their needs and respond to them in a

When I began this action research, I had only thought about using the technology for assessments, but now I am able to see the benefits of using it throughout the course of instruction and assessment. This action research project allowed me to expand my perspective and include the use of computer based assessment for students who show increased achievement as well as causing me to look at other ways to utilize the technology that I am currently using for assessment during instruction as well.

VALUE

The research completed during this action research project is important to me and has been instrumental in changing my personal teaching practices. I do not want to become a stagnant teacher that always does the same thing each year. Student populations and available technology resources are constantly changing which means that my practices as a professional educator have to change with them. A famous quote says,

"that if you do what you have always done, you will get what you have always gotten". As I have completed this study, I have even more questions than I started with. For example, how does mode of instruction impact the mode of assessment? If I present content and using a “flipped” method, will students be more successful on CBT? I am also curious how student age impacts their achievement using technology in classroom settings. Are older students more successful than younger students? How will I be impacted becoming more of a facilitator rather than an instructor? I am very curious to see where this study leads me in exploring different methods of instruction.

Teachers need to help students see that there are many ways to do things and that change is inevitable. My students see me trying new things and constantly learning. They will hopefully take away from being a part of this action research, that learning and knowledge is a fluid state. I hope that other teachers will be impacted by this and try to meet their students’ needs in classroom by utilizing technology during assessments. Many times we hear in professional development sessions that we need to differentiate instruction, but there is no differentiation of assessment. I hope that I will be able to present this information to my peers through possible presentation opportunities at local service centers and possibly at a state-wide Conference for the Advancement of Science Teachers for science educators in Texas.

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APPENDICES

APPENDIX A

MSU IRB EXEMPTION

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

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MEMORANDUM

TO: Coreen Dingler and Walt Woolbaugh

FROM: Mark Quinn, Chair Mark Quinn CTJ

DATE: November 14, 2013

RE: *"How is Student Achievement on Assessments Impacted by the Use of Computer-Based Tests?"* [CD111413-EX]

The above research, described in your submission of November 14, 2013, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

STUDENT TECHNOLOGY USE SURVEY

Student Technology Use Survey

What is your name? (Last Name, First Name) *

General Hardware *Of the following choices, please choose which technology devices that you have available to you to use at home.

- Personal Computer
- Laptop Computer
- Smart Phone
- MP3 Player (ipod or other types)
- Tablet (iPad or android tablet)
- Other:

How often do you access the internet at home for entertainment? *
1=Never 2=Rarely 3= Every once in a while 4=Sometimes 5=Almost Always

1 2 3 4 5

How often do you access the internet at home for academic websites? *
1=Never 2=Rarely 3= Every once in a while 4=Sometimes 5=Almost Always

1 2 3 4 5

How often do you access the internet at home for general information? *
1=Never 2=Rarely 3= Every once in a while 4=Sometimes 5=Almost Always

1 2 3 4 5

How often do you access the internet at home for research? *
1=Never 2=Rarely 3= Every once in a while 4=Sometimes 5=Almost Always

1 2 3 4 5

How often do you access the internet at home for social interaction? (Facebook, Instagram, Twitter, etc.) *1=Never 2=Rarely 3= Every once in a while 4=Sometimes 5=Almost Always

1 2 3 4 5

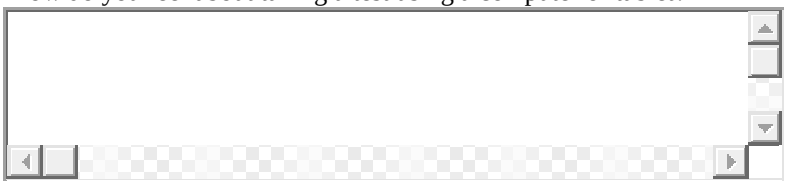
How often do you access the internet at home for reading? (books, magazines, etc) *
1=Never 2=Rarely 3= Every once in a while 4=Sometimes 5=Almost Always

1 2 3 4 5

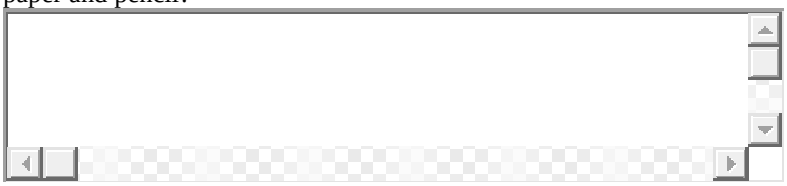
Please choose any of the following listed technology devices that you have used. *Before this school year, which of the following listed devices have you used for an assessment at school?

- iPad
- Laptop
- Desktop Computer
- Responder/Clicker
- Cell Phone
- Other:

How do you feel about taking a test using a computer or tablet? *



How do you feel about taking a test using paper and pencil?How do you feel about taking a test using paper and pencil?



A link to the live Google Form used by students is as follows:

https://docs.google.com/forms/d/16vkym9MYFH9dfu2UxMjCaCY38a-AEo04ElhNQOkHqKc/viewform

APPENDIX C

STUDENT ATTITUDES ABOUT ASSESSMENT SURVEY

Student Attitude Survey

What is your name? (Last Name, First Name)

What grades do you usually get in science?Not sure= 0 Mostly D's or F's=1 Mostly C's=2 Mostly B's=3 Mostly A's=4

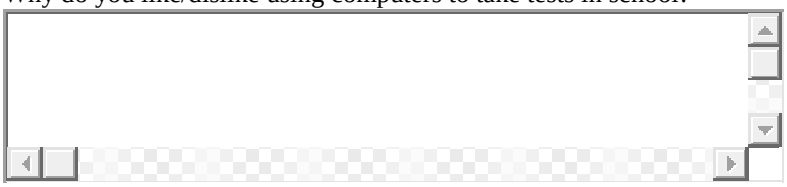
	0	1	2	3	4	
Not Sure	●	●	●	●	●	Mostly A's

To what extent do you agree or disagree with each of the following statements about science? *

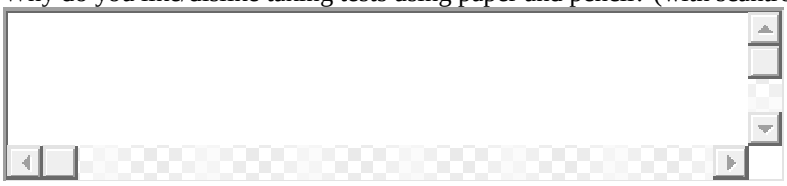
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
I enjoy science class.	●	●	●	●	●
Science makes me feel nervous or upset.	●	●	●	●	●
I feel like I am good at science.	●	●	●	●	●
Science is difficult for me	●	●	●	●	●
I like doing activities in class using computers.	●	●	●	●	●
I feel uncomfortable using computers in class.	●	●	●	●	●
When I am at home I like to use technology	●	●	●	●	●
I feel nervous when I have to take a test on the computer in any subject.	●	●	●	●	●
I feel nervous when I have to take a test using paper and pencil in any class.	●	●	●	●	●
I like to take Accelerated Reader tests on the computer.	●	●	●	●	●

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
I like to take Accelerated Reader tests using an iPad.	●	●	●	●	●
I like to complete Accelerated Math objectives on the computer.	●	●	●	●	●
I wish my teachers used more technology in the classroom.	●	●	●	●	●

Why do you like/dislike using computers to take tests in school?



Why do you like/dislike taking tests using paper and pencil? (with scantrons)



A link to the live Google Form used by students is as follows:

https://docs.google.com/forms/d/1nL6fZw3jgqNXZ0gk3yOJt_7CFYlugfI8-qSnq3H286I/viewform

APPENDIX D

GRASHA-REICHMANN TEACHING STYLE SURVEY

Teaching Style Survey

(Grasha-Riechmann)

The following is a Grasha-Riechmann teaching style survey. Respond to each of the items below in terms of how you teach.

If you teach some courses differently than others, respond in terms only of one specific course. Fill out another survey for the course(s) that you teach in a different style.

Try to answer as honestly and as objectively as you can.

Resist the temptation to respond as you believe you should or ought to think or behave, or in terms of what you believe is the expected or proper thing to do.

Respond to questions below by using the following rating scale:

1 = strongly disagree | 2 = moderately disagree | 3 = undecided | 4 = moderately agree | 5 = strongly agree

1.	Facts, concepts, and principles are the most important things that students should acquire.	**Response:** ☐
2.	I set high standards for students in this class..	**Response:** ☐
3.	What I say and do models appropriate ways for students to think about issues in the content.	**Response:** ☐
4.	My teaching goals and methods address a variety of student learning styles.	**Response:** ☐
5.	Students typically work on course projects alone with little supervision from me.	**Response:** ☐
6.	Sharing my knowledge and expertise with students is very important to me.	**Response:** ☐
7.	I give students negative feedback when their performance is unsatisfactory.	**Response:** ☐
8.	Activities in this class encourage students to develop their own ideas about content issues.	**Response:** ☐

1 = strongly disagree

2 = moderately disagree

3 = undecided

4 = moderately agree

5 = strongly agree

1 = strongly

9.	I spend time consulting with students on how to improve their work on individual and/or group projects.	**Response:** ☐	**disagree** **2 = moderately disagree** **3 = undecided** **4 = moderately agree** **5 = strongly agree**
10.	Activities in this class encourage students to develop their own ideas about content issues.	**Response:** ☐	
11.	What I have to say about a topic is important for students to acquire a broader perspective on the issues in that area.	**Response:** ☐	
12.	Students would describe my standards and expectations as somewhat strict and rigid.	**Response:** ☐	
13.	I typically show students how and what to do in order tomaster course content.	**Response:** ☐	
14.	Small group discussions are employed to help students develop their ability to think critically.	**Response:** ☐	
15.	Students design one of more self-directed learning experiences.	**Response:** ☐	**1 = strongly disagree** **2 = moderately disagree** **3 = undecided** **4 = moderately agree** **5 = strongly agree**
16.	I want students to leave this course well prepared for further work in this area.	**Response:** ☐	
17.	It is my responsibility to define what students must learn and how they should learn it.	**Response:** ☐	
18.	Examples from my personal experiences often are used to illustate points about the material.	**Response:** ☐	
19.	I guide students' work on course projects by asking questions, exploring options, and suggesting alternative ways to do things.	**Response:** ☐	
20.	Developing the ability of students to think and work independently is an important goal.	**Response:** ☐	
21.	Lecturing is a significant part of how I teach each of the class sessions.	**Response:** ☐	**1 = strongly disagree** **2 = moderately disagree** **3 = undecided** **4 = moderately agree** **5 = strongly agree**
22.	I provide very clear guidelines for how I want tasks completedin this course.	**Response:** ☐	
23.	I often show students how they can use various principles and concepts.	**Response:** ☐	
24.	Course activities encourage students to take initiative and responsibility for their learning.	**Response:** ☐	
25.	Students take responsibility for teaching part of the class sessions.	**Response:** ☐	

26.	My expertise is typically used to resolve disagreements about content issues.	**Response:** ☐
27.	This course has very specific goals and objectives that I want to accomplish.	**Response:** ☐
28.	Students receive frequent verbal and/or written comments on their performance.	**Response:** ☐
29.	I solicit student advice about how and what to teach in this course.	**Response:** ☐
30.	Students set their own pace for completing independent and/or group projects.	**Response:** ☐
31.	Students might describe me as a "storehouse of knowledge" who dispenses the fact, principles, and concepts they need.	**Response:** ☐
32.	My expectations for what I want students to do in this class are clearly defined in the syllabus.	**Response:** ☐
33.	Eventually, many students begin to think like me about course content.	**Response:** ☐
34.	Students can make choices among activities in order to complete course requirements.	**Response:** ☐
35.	My approach to teaching is similar to a manager of a work group who delegates tasks and responsibilities to subordinates.	**Response:** ☐
36.	There is more material in this course than I have time available to cover it.	**Response:** ☐
37.	My standards and expectations help students develop the discipline the need to learn.	**Response:** ☐
38.	Students might describe me as a "coach" who works closely with someone to correct problems in how they think and behave.	**Response:** ☐
39.	I give students a lot of personal support and encouragement to do well in this course.	**Response:** ☐
40.	I assume the role of a resource person who is available to students whenever they need help.	**Response:** ☐

1 = strongly disagree

2 = moderately disagree

3 = undecided

4 = moderately agree

5 = strongly agree

APPENDIX E

ACTIVE PARTICIPANT JOURNAL

CBT vs. PPT Participant Observation Comments Table

	Cycle 1				Cycle 2		
	PPT	CBT	FALL RIT		PPT	CBT	WINTER RIT
student/computer ratio	not needed	1 iPad per student was used for this.	1 iPad per student was used for this.		not needed	1 iPad per student was used for this.	1 iPad per student was used for this.
Software Application	SuperNote app for students with oral admin. Accomodation	Google Drive, Google Forms, Safari, SuperNote	Safari		SuperNote app for students with oral admin. Accomodation	Google Drive, Google Forms, Safari, SuperNote	Safari
Technology Users	teacher was the only technology user (scanning scantrons for data analysis using DMAC	Students and Teacher	Students and Teacher		teacher was the only technology user (scanning scantrons for data analysis using DMAC	Students and Teacher	Students and Teacher
Hardware issues	not applicable	none	Sometimes the iPad would "freeze" and the student would be locked out of a tessting session. I had to login as the test admin to suspend their test and then restart the test. It was very frustrating, but I got the hang of it pretty quick. The students seemed anxious about having "broken it."		not applicable	none	none
Software Issues	none	After 6 class periods, I was very frustrated. I had to set up 24 iPads with Google Drive.	Safari froze at least once in each class period, with one class period experienceing 4 students who had to restart the test due to the app freezing and having to restart the iPad.		none	The software and apps worked correctly, but the network prevented 4 class periods from completing their assessment on the assigned day and resulted in some "down time"	none
Network Issues	none	The Intermediat campus that I work at had filters up that would not allow "Google" drive access on iPads for students. I had to have my principal give permission to the district IT director to remove those filters. This was fixed quickly, but was still an issue.			none	MANY! The district Instructional Technology Director had to be called to my classroom to troubleshoot network issues. Only 2 classes were able to test successfully with no issues. 4 classes had no network connectivity	None! This worked flawlessly today.
Length of time needed for students to complete tests	(2) 50 minute class periods was the length of time the majority of students needed to complete the test	students took between 30-45 minutes to complete this test	30-75 minutes was the time it took for students to complete the test.		(2) 50 minute class periods was the length of time the majority of students needed to	students took 25-40 minutes to take this test	25-80 minutes was the time it to for students to complete the test

					complete the test and fill out the scantrons bubble sheet		
Other Comments	Not all students had who oral admin as an accommodation had had their ear bud for the test administration. This caused a delay in their testing while I located headphones for them to use. After this administration I made sure to have a class set of headphones.	It was much easier for students who were absent to make up this test. Students did not miss more class time to make up the test. It could be assigned to be completed at home.	Some students had to miss part of another class due to having to finish their test session. They were frustrated by this, especially if they missed part of their PE time.			This administration was easier for me as a facilitator. I did not have to help with opening the apps and getting students to open the right files. They already knew what to do.	This administration went very smoothly compared to the first one. Students seemed much more relaxed and knew what to do with the iPads and apps almost without being told.

APPENDIX F

STUDENT DATA: PRE-TREATMENT AND TREATMENT CYCLES 1 AND 2

Student Data on Pre-Treatment and Treatment for Cycle1 and Cycle 2

First	Age	G	At - Risk	LEP	SPED	504		Fall RIT	Winter RIT	Spring RIT	Unit 1 Test	Unit 2 Test	Unit 3 Test Part I	Unit 3 Test Part II	Science Benchmark
JULIAN	11	M	x					***	202	208	32	64	63	35	48
CHRISTOPHER	10	M						214	218	217	88	88	94	85	86
JACEY	11	F						217	213	223	94	80	88	70	86
DIEGO	10	M						207	215	212	76	52	56	65	77
CLARISSA	11	F	x	x				200	192	200	56	52	31	40	45
JESSICA	11	F	x		x			195	199		44	76	44	35	32
ANGEL	10	M	x					197	207	203	79	52	75	65	84
ISAIAS	12	M	x					194	199	204	59	80	50	45	39
ELIANA	12	F	x					197	186	193	32	52	94	40	55
SAMANTHA	11	F						216	212	219	85	84	100		91
JAFET	11	M	x					211	213	218	91	80	81	80	82
HELENE	11	F						214	219	223	91	76	88	80	70
ZAKK	11	M	x		x			***	205					60	70
ZACHERY	11	M						***	205	213	74	84	69	70	68
STEVE	11	M	x					223	217	216	79	84	81	70	84
LILLIAN	10	F	x					215	226	221	74	92	100	65	91
CORTEZ	11	M	x					195	194	201	53	68	69	25	43
LOGAN	11	M	x					202	207	214	65	72	81		57
KOBE	11	M						203	202		65	72	69	55	43
ISAAC	10	M	x	x				205	204	212	74	84	56	75	82
MADISUN	10	F	x					199	***	206	65		44	45	52
FERNANDO	10	M	x					197	198	202	65	72	69	50	36
HANNAH	10	F						212	222		82	84	81	80	82
AILEEN	10	F	x		x			192	200	196	56	40	44	30	64
MAKAYLA	11	F						215	210	220		76	56	55	89
ELLA	11	F	x					201	197	202	47		50		50

COBY	10	M	x		x		193	190	195	65	76	69	45	41
EMILY	10	F					***	213		91		75	75	89
ALYSIA	10	F	x				***	***	190	59	80	94		68
SERGIO	12	M		x	x		197	201		56	56	81	50	70
PRESLIE	11	F			x		***	214	213	74	80	75	80	84
NATHANIEL	10	M	x	x			211	205		65	80	69	50	82
NATAJA	10	F	x				216	216	229	79		81	75	89
CHRISTIAN	11	M	x		x		***	190	196	35	56	38	35	36
NOAH	10	M					215	212	219	88	88	69	85	84
SHERLY	11	F	x	x			187	191	196		52	13	30	55
CASEY	11	M					205	219	215	74	88	94	65	75
ANGEL	11	F					***	***	205		80	63	60	55
WESTON	11	M	x				198	209	211	56	68	75	65	43
JALIYAH	10	F					196	195	198	56	80		50	41
ZARIAH	11	F	x				189	191	204	53	44	50	40	52
HAILEY	11	F	x				205	204	208	65	76	69	50	61
CONNER	11	M					***	212	222	74	96	88	80	89
SIANNA	11	F	x				207	212	208			56	60	
EDWARD	10	M	x	x			211	207	208	71	80	75	65	68
VICTORIA	11	F	x				***	205	208			69	60	66
AZLIN	11	F	x				188	***	201	56	28	44	40	41
LILLIANA	10	F					196	204	202	59	44	56	55	50
JOSE	11	M	x			x	194	190	199	44		44	70	57
ALYSSA	11	F					209	221		85	84		85	75
ETHAN	12	M					***	***	226					93
RAYMOND	11	M	x			x	192	203	203	59	56	88	50	55
MARIO	11	M	x				***	207	207	74	80	63	60	64
JEREMIAH	11	M	x				204	207	215		88		60	73
JACKSON	11	M					***	212	212	71	72	81	60	70
MYKAH	11	F	x				195	197	205	71	76	31	60	61
GERALD	10	M					203	210	215		88	88	50	75
JOSHUA	11	M					219	218	213	91	96	100	80	84
CHRISTIAN	11	M	x			x	190	198	201	68		63	35	50

CHRISTOPHER	11	M	x		x	x		187	196	195	38	44	44	50	30
EBRIANA	11	F						211	211	212	79	92	75	80	
JAYLON	11	M	x					207	206	213	68	76	81	70	68
DAVID	10	M	x	x				196	198		62	56		60	52
JOSE	11	M	x					203	210	213	71	84	94	80	86
BRANDON	10	M	x					216	206	211	62	68	81	80	70
ANGELICA	11	F	x					204	209	216	71	76	88	70	75
ANEESIA	10	F						***	207	213	74	76	75	80	64
DELIA	10	F	x	x				220	204	196	62	64	56	30	45
NATALIE	11	F				x		***	209	200		60	38	35	66
XAVIER	11	M	x	x		x		191	199	204	44	48	25	45	39
ELIAS	11	M	x					203	203	214	68	68	56	55	68
ERIC	10	M						222	215	231	94	92	100		89
DRAVEN	12	M						***	215	218			69	80	
TRINITY	11	F						201	201	209	68	72		50	59
ALEAHA	12	F	x					***	198	206	62	60	69	20	64
MIA	11	F						196	197	209	68	52	44	55	59
JAYDON	10	M						202	203	196	65	80	63	55	48
JULISSA	11	F	x					204	206	212	74	76	75	65	59
MACKENZY	11	F						216	219	219	76	92	100	80	86
DOMINIC	11	M	x					207	204		62	76	69	55	45
THOMAS	10	M	x	x				197	201	201	74	56	94	35	75
ABISAHI	11	M	x	x				196	197	200	50	52	50	35	41
JOSEPH	11	M	x			x		***	202	216	68	76	63	60	61
VAIDEHI	10	F						216	219	217	85	92	94	80	84
CARLOS	12	M	x	x				186	196	191	53	36	50	35	36
DAYLAN	10	M						***	***	213	85		75	75	70
GARRET	10	M						223	228	221	94	92	94		
DALANA	11	F	x					200	199	213	68	76	44	50	59
SHAKIA	11	F	x		x			***	180				38	15	
ZAYDA	11	F						192	199	201	71	68	56	50	45
KAJAH	11	F			x			191	189	202	50	60	56	50	64
BYRON	11	M						202	211	205	74	64	63	55	75

MONTREZ	11	M					195	195	202	56	64	50		50
AUSTIN	12	M	x	x			190	198	206	50		50	35	55
LUIS	12	M	x	x		x	197	193		59	60	56	25	50
REED	11	M					221	221	222	74	88	100	90	93
CRISTABEL	10	F					***	201	203	62	72	38	55	55
A'LEIYAH	10	F					201	201	206	53	76	100	60	55
MIA	10	F					***	203	203	62	76	38	65	52
HALLE	10	F					195	201		59	68	50		52
MICHALYE	11	F					213	203	214	68	84	81	80	82
EMILY	10	F					200	204	207	53	68	75	50	66
DAVID	11	M					206	210	212	85	88	94		61
RAUL	11	M					214	213	210	85	88	81	80	75
DAMYAN	10	M		x		x	194	188	196	41	52	31	25	36
ISMAEL	10	M	x	x			201	200	213	53	80	50	40	61
KATHERINE	11	F	x	x			***	***			68	38	60	41
MALLORIE	11	F	x				203	209	208	59	60	81	70	70
IAN	11	M					202	209	217	71	76	100	70	70
EDUARDO	11	M	x				***	***	206			69	55	
JACOB	11	M					197	193	198	47	60	50		43
BRENDAN	11	M					212	210	216	94	80	94	75	89
KIARA	11	F		x			206	203	212	59	60	81	60	61
JACOB	10	M					***	224	223	88	92	88	85	93
CASSANDRA	11	F					210	210	216	85	80	56	80	77
JOSIAS	11	M					220	217		82	96	75	85	95
ALEXUS	11	F				x	197	201	205	79	64	69	45	68
CHRISTIAN	11	M					214	209	216	74	76	100	90	80
MAGALY	11	F					***	***			76	69	75	57
RAYLEI	10	F					217	222	223	85	92	100	85	98
JESSICA	11	F					210	210	221	79	80	69	75	
CHRISTOPHER	10	M					196	203	194	47	64	31	50	50
DARRELL	10	M				x	***	222	218	88		100	95	
REAGAN	10	F					214	212		82	96		75	91

LARRY	11	M	x			x		203	202	217	71	60	88	55	84
HALEY	11	F						***	***						41
MASON	11	M	x					205	209	210	76	76	69	55	52
ABIGAIL	10	F						***	218	220	88	88	94	90	89
EMMA	10	F						207	213	215	85		81	65	77
JAYLON	11	M	x					206	218	211			81	60	68
HANNAH	11	F						***	216	213	71	96	69	85	68
JADA	10	F	x					207	209	210	59	72	63	45	61
NOLAL		M						***	***	221					73
CHRISTOPHER		M						***	***	217					64
HASTITY		F													68

APPENDIX G

POST TREATMENT SURVEY

Post Treatment Survey

* Required

Last Name *

First Name *

Gender *

Which of the following technology devices do you have for your use at home? *
Choose all that apply

- o ☐ iPad or other Apple device
- o ☐ Cell Phone
- o ☐ Android Tablet
- o ☐ Kindle or Nook
- o ☐ Gaming Console (xbox, etc.)
- o ☐ Laptop Computer
- o ☐ Desktop Computer
- o ☐ None

How often do you access the internet at home for entertainment? *
1=Never 2=Rarely 3=Every Once in a While 4=Sometimes 5=Almost Always

	1	2	3	4	5	
Never	●	●	●	●	●	Almost Always

What type of entertainment do you use it for? *

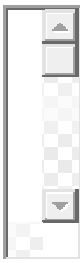
How often do you access the internet at home for academic websites? *
1=Never 2=Rarely 3=Every Once in a While 4=Sometimes 5=Almost Always

	1	2	3	4	5	
Never	●	●	●	●	●	Almost Always

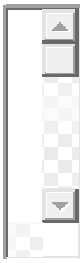
What are some educational websites that you visit? *

How do you feel about taking a test using paper and pencil? *

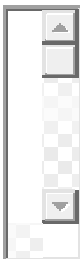
Why do you feel that way?



How do you feel about taking a test using a computer or tablet? *
Why do you feel that way?

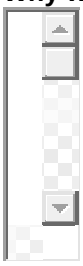


How do you feel about using technology in the classroom? *
Why do you feel that way?



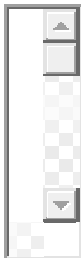
If you were able to choose how you are assessed in class, which would you choose? *

Why would you choose that? *



Which method of assessment do you feel like you are more successful at? *

Why do you feel more successful at the method that you chose? *



I understand that participation in this research is voluntary and participation or non-participation will not affect my grades or class standing in any way. *

☐ I agree

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https://docs.google.com/forms/d/1DxFk5quV1XM2fBrPABFunN4-UBmr5h9gYjpLMtusFJ0/viewform