STUDENT PERCEPTION OF DIFFERENT TESTING MODES IN SEVENTH GRADE

ENGLISH LANGUAGE ARTS COMPUTER-BASED TESTING ADMINISTRATION

by

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CERTIFICATION OF THESIS/PROJECT CAPSTONE WORK

We, the undersigned, certify that this project entitled STUDENT PERCEPTION OF DIFFERENT TESTING MODES IN SEVENTH GRADE ENGLISH LANGUAGE ARTS COMPUTER-BASED TESTING ADMINISTRATION by Nicole Kashino, Candidate for the Degree of Master of Science in Education, Curriculum and Instruction in Inclusive Education, is acceptable in form and content and demonstrates a satisfactory knowledge of the field covered by this project.

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Abstract

The purpose of this research was to determine which computerized devices are most appropriate when administering a high-stakes computer-based assessments to students. Participants in the study included twenty-two seventh grade students. The study was designed to have students complete a New York State Grade 7 English Language Arts Computer-Based Assessment using one of three electronic devices. The researcher collected data in the form of anecdotal notes, student questionnaires, and student interviews. The results of the study concluded that students were uncomfortable testing on electronic devices however, students preferred larger screens and the ability to use handheld manipulatives such as a mouse or stylus to navigate a screen rather than a touch pad or touch screen.

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Introduction

Problem

The present study investigates the problem of selecting an appropriate device to use for computer-based testing and more specifically high-stakes computer-based testing. With the rising uses of technology in schools, teachers are being asked how they are able to use devices in the classroom and even more importantly in their assessment practices. The Race to the Top (RTTT) Initiative highlighted the importance of computer-based high-stakes testing with grant money being awarded to two consortia by the names of PARCC, more specifically known as Partnership for Assessment of Readiness for College and Careers, and Smarter Schools. With the support of RTTT funds, these consortia began to develop computer-based tests in order to accommodate national state assessment mandates (Doorey, 2013).

With these computer-based assessment mandates, it is the school's responsibility to provide students with appropriate devices to take the test. Because not all devices are built the same, and each has their own benefits and drawbacks, this creates a problem for schools when purchasing devices for students in order to accommodate to new testing formats.

Purpose

The purpose of this study was to administer a computer-based assessment to students resembling the format of previously published New York State (NYS) English Language Arts (ELA) assessments on three different devices including Dell desktop computers, Microsoft Surface Tablets, and Apple iPads (three different groups of students). During the assessment, the researcher, who is also the Computer Teacher and Technology Coordinator in the school, will observe students and take notes during the administration of the assessment to collect data regarding student reactions and frustrations during the test. Once the assessment is complete, the

researcher will implement a student questionnaire and use the observational notes to determine

which students to interview in order to gain further insight to their testing experiences specific to

their testing devices. The data collected during the study will lead the researcher to the

conclusion as to what computerized devices are most appropriate when administering a high-

stakes computer-based assessment in addition to other assessments relating to their coursework.

Significance

Although the results of this study could be used by many to make informed technology

purchases, this study is significant specifically to Saint Benedict School in Amherst, New York

where the study is being conducted. In this school, students currently use a variety of electronic

devices in order to integrate technology into their curriculum and assessment including desktop

computers of various Dell models, Microsoft Surface Tablets versions 2 and 3, and Apple iPads

versions 2 and Air. The school is currently looking to purchase more devices for students to use

in order to accommodate upcoming computer-based testing mandates; however, it is unclear

what devices are more beneficial. By implementing this study, the researcher, who also serves as

the Technology Coordinator for the school, will be able to make a research-based decision as to

what devices should be purchased with the intent for students to use them for computer-based

testing purposes.

Literature Review

Driving Forces

No Child Left Behind. The No Child Left Behind Act, commonly known as NCLB, was initiated in 2001 by President George W. Bush as a means of education reform. The purpose of this framework was to improve the performance of America's schools and ensure that our neediest students do not slip through cracks of the education system. In order to do this, NCLB had several goals, one of which was to increase the accountability of the schools, school districts, and States as a whole. In order to be held more accountable, States needed to establish challenging State standards in the areas of ELA and Mathematics while assessing their students annually in grades 3-8. In addition, annual statewide progress objectives needed to be established and broken down by race, ethnicity, poverty, learning disability, and limited English proficiency in order to ensure that all students within the education system would be able to reach proficiency in each of the content areas within their twelve school-age years, while ensuring that no student gets left behind in the educational system (No Child Left Behind [NCLB], (2002)). NCLB ended in 2015, however, much of the testing and accountability approach to education has carried over to its predecessor, the Every Student Succeeds Act (ESSA) in 2016 (Every Student Succeeds Act of 2016).

Common Core State Standards (CCSS). In 2009, the CCSS Initiatives stemmed from several issues in education around the country including differences in state academic expectations throughout the United States and the changes in emerging jobs. These changes created a need for changing attained skill sets among students in order to be more competitive and successful in the workplace. Since that time, new standards for ELA which included College and Career Readiness Standards and new standards for the content area of mathematics have been published. The CCSS have been released to schools across the United States, however it is

important to note not all states have adopted the standards. As of today, only forty-six of the

fifty states have fully adopted the CCSS (ASCD, 2016). Nevertheless, having teachers across

the country responsible for teaching the same skills is a way to ensure that students in all states

are receiving the same amount of quality curriculum and instruction each school year. The

CCSS also work to accommodate to our 21st century world and allow our students to receive

instruction nationally that prepares them for a successful future in that world (Doorey, 2013).

Race to the Top Initiative. The Race to the Top (RTTT) Initiative was launched by the

Department of Education in 2010 with several goals including supporting teachers to become

more effective, increasing the importance and interventions in low performing schools,

developing better assessments to match more rigorous standards, and adopt better ways to

evaluate assessment data in order provide teachers, parents, and schools detailed information

about student progress (The White House, 2016). In response to the need to accomplish these

goals, the RTTT Initiative began to fund the development of new assessment systems that would

align to the new Common Core Learning Standards. PARCC and Smarter Balanced were two

consortia that were awarded RTTT grants in order to develop these assessments, which will

serve as the new common assessments for students in grades 3-8 as a way to fulfill the NCLB

assessment requirements (Doorey, 2013).

PARCC. The Partnership for Assessment of Readiness for College and Careers was

funded by the RTTT Initiative to develop new assessments as a way to fit the needs of our

students as 21st Century learners in order to succeed beyond their K-12 education. The PARRC

consortium consists of a staff of national assessment experts in regards to assessment design and

development, and experts in the areas of ELA/ Literacy and Mathematics, the CCSS, outreach,

communications, and state policy (PARCC, 2016).   Affiliated with the Pearson Education

Corporation these assessments and their framework have been used throughout the United States

in order to evaluate students in the content areas of ELA/Literacy and Mathematics (Pearson,

2016). States currently using the PARRC Assessments in the 2015-2016 school year to evaluate

student learning include Colorado, District of Columbia, Illinois, Maryland, Massachusetts, New

Jersey, New Mexico, and Rhode Island. The PARRC Assessments are also used within the

Bureau of Indian Education, the Department of Defense Schools, and throughout some parts of

Louisiana (PARCC, 2016). While up until recently, New York had a contract with Pearson to

develop their state assessments and therefore was following the PARRC Assessment framework,

the state has recently decided to sign a contract with the company Questar (Harris, 2015).

     Smarter Balanced. The Smarter Balanced Assessment Consortium was also funded by

the RTTT Initiative in order to develop new assessments as a way to fit the needs of our students

as 21st Century learners in order to succeed beyond their K-12 education. The consortium allows

for state education staff, teachers, faculty members in higher education and other educators to

work collaboratively in order to create an assessment that is the "best of the best" and that

ultimately prepares students for not only college but for their future careers as well. Developed

in 2010, the group looked to redefine the current assessment systems that had become outdated

with the rise in technology and changing career options. Feature characteristics including: online

administration, student customization, test questions that measure essential college and career

readiness skills such as critical thinking, problem solving, and writing, features and

accommodations that result in a fair testing environment for all students, and a platform to

support teachers in their professional development as well as classroom assessment tools

(Smarter Balanced Assessment Consortium, 2016). States currently administering Smarter

Balanced Assessments include Washington, Oregon, Montana, Idaho, Nevada, California, North

Dakota, South Dakota, Michigan, West Virginia, Delaware, Connecticut, New Hampshire, Vermont, Hawaii, and the U.S. Virgin Islands. States North Carolina, Iowa, and Wyoming do not administer the Smarter Balanced Assessments however still act as affiliate members of the consortia by providing guidance in the development of the assessment system, and participating in work groups (Smarter Balanced Assessment Consortium, 2016).

Computer Based Testing

With these new standards and initiatives, educators are now seeing a change in assessment delivery to reflect the changing technology (Doorey, 2013). Due to a rise in classroom technology usage there is now a push to deliver state assessments on computer-based platforms whether it be a desktop, laptop, netbook, or tablet device. Due to the transition from traditional paper-based testing to computer-based tests it is crucial that educators, administrators, and school districts are fully aware of how administering tests in this way could be seen as a positive for both students and teachers, how these tests may present challenges, how students are expected to achieve in comparison to paper-based exams, how to create ideal testing environments for students, and how to overall prepare for the administration for computer-based tests.

Benefits. Numerous benefits result from computer-based testing. From the testing agency's perspective, money is undoubtedly saved by creating and selling computer-based assessments rather than paper-based assessments. By doing so, the testing agencies do to not have to spend money on printing and shipping their exams state-wide or even nationally (Parshall 2002).

An additional benefit to using computer-based tests is their security and storage ability. It is much easier to store and protect a digital file than it is to store and lock away stacks of paper

exams. Computer-based exams automaticity feature is another tremendous benefit due to the

data collection for the tests occurs automatically during the administration of an exam and

therefore simplifies the scoring process for teachers (Parshall 2002).

In addition to obtaining their score, technology-based testing can help students identify

correct and incorrect answers, the types of errors that were made, and the topics and

concepts that they need to review. Students and teachers can then examine these data to

assess why specific items were incorrect and what they can do to learn the content being

tested (Salend 2009, pp.46.)

In the age of inclusive education, students with disabilities are members of the

mainstream classroom and therefore are expected to take the same assessments. In this particular

case, computer-based tests are a huge break-though as they allow for easier accessibility among

students with disabilities. With the capability of implementing various accommodations for

students, these computer-based tests reflect a Universal Design for Learning (UDL), promoting

student accessibility and the promotion of learning for all students (Salend, 2009).

Accommodations that computer-based tests are able to make for these students includes larger

print, audio support, and alternate input devices for students who are unable to write or type their

answers to test items (Parshall, 2002). Having an assessment that accommodates to a student's

needs on its own can save a school or district immense amounts of money in the sense that they

do not have to hire a physical person to read for a student or assist them on the testing day,

especially in the case of high-stakes state testing examinations (Schaffhauser, 2011).

Often a major benefit to computer-based testing, similarly referred to as e-assessment for

its electronic format, is the immediate feedback and scoring that it has the ability to produce

which can often be a valuable resource in the realm of special education. Researchers Jordan

and Mitchell stated, "E assessment enables feedback to be delivered instantaneously. This

provides an opportunity for students to take immediate action to "close the gap" between their

current level and a reference point, and thus feedback to be effective" (Jordan & Mitchell, 2009).

If a teacher's test results determine how they should proceed with their instruction, computer-

based testing offers a tremendous advantage to teachers who are looking to provide their students

with meaningful instruction as well as developed interventions in order to allow all students to

achieve success in the classroom. If a teacher were to take too long in the grading process of an

assessment, the results may actually mean very little by the time the data can be applied to the

student's instruction.

       Negative Effects. Taking an assessment on a computer can present numerous challenges

to test takers as explained in the book Practical Considerations in Computer-Based Testing

written by Cynthia G. Parshall in 2002. Generally, it has been found that it is more difficult for

students to read off of a screen than it is to read on a piece of paper and researcher Muter noted

that reading from a computer was actually slower that reading from a book (Muter, 1996).

Computer-based exams that incorporate lengthy reading passages present a challenge to test

takers, as they need to scroll down the page to continue reading. This also becomes a problem

when a student tries to scan back in the passage to find evidence to answer test items correctly.

On a paper-based exam, test takers are able to freely annotate directions, passages, and questions

as a strategy to better answer a test item. While on a computer-based test, this is generally not

the case, which can make taking the exam more difficult for some students and interfere with

their test taking strategies (Parshall, 2002). It has also been reported by test takers that the

inability to omit questions for later response can cause frustration to the examinees (Powers &

Potenza, 1996). When taking a test, many students utilize their ability to skip questions when

they are unable to formulate an answer with the intention that they will return to the test item later. If a student is required to answer a test question that they are unsure of immediately, the student may be overcome with test anxiety.

Student Perception. Due to the rise of technology in the classroom, many schools are moving toward assessing their students in specific content areas using a computer-based format. Due to this change in test administration, various studies have been conducted concentrating on not only test results but student attitudes as well when comparing computer-based assessments to their paper-and-pencil versions.

The studies of Choi and Tinkler (2002), Johnson and Green (2006), Pomplun (2007) and Yurdabaken and Uzunkavak (2012) all place an emphasis on uncovering student attitudes about computer-based assessments. In order to gain feedback from students Yurdabaken and Uzunkavak (2012) conducted a purely qualitative study in Turkey where they created their own 35-item scale, which was completed by a total of 784 students in grades 3, 4, and 5. Similarly, Choi and Tinkler (2002) used a survey in their study to measure student attitude using 800 students in grades 3 and 10 after administering assessments in both reading and mathematics. What the researchers discovered in this survey was that although students had an overall positive attitude about computerized assessments, their performance could have been impacted by unfamiliarity with using a computer. For example, students with less experience on the computer may have struggled with reading passages due to having to adapt to scrolling down a computer screen. In all four studies researchers found that students were in favor of computer-based tests in comparison to their paper and pencil counterparts. Research conducted by Pomplun in 2007 also used surveys to collect data about student attitudes. Pomplun's student survey consisted of 22 questions regarding their computer experience in addition to overall

testing experience. Like similar studies, it was found that while students preferred the electronic

testing format, they do not perform favorably unless they have a strong computer background.

With computer experience found to be a factor in student perception and success on computer-

based tests it should be considered that,

> Educators can work toward providing all of their students with the preparation they need
>
> to use a wide range of technologies… educators can provide students with numerous
>
> opportunities to use technology in daily classroom instructional activities and explicitly
>
> teach students the skills needed to use specific technologies and take technology-based
>
> tests (e.g., keyboarding skills, scrolling with a mouse, and accessing text on multiple
>
> screens) (Salend, 2009, pp. 49).

To collect qualitative data Johnson and Green (2006) interviewed eight 11-year-old

students after being administered an assessment in the area of mathematics. In their interview's,

it was discovered that most students were in favor of the computer-based test rather than the

paper and pencil based exam. Students reported that the test on the computer felt easier and that

they were doing less writing while only one of the eight students felt that the exam on the

computer was more difficult that its paper-based counterpart (Johnson& Green 2006).

In a study done with forty-six 17-year-old students in order to establish how the mode of

test administration affects a student's performances on items that require extended responses

many students had negative feelings about the computer-based assessment. Before the students

were given an English Literature assessment based upon their course work, they were given a

questionnaire that asked their level of computer proficiency and if given the choice would they

rather take an essay exam that is hosted on a computer or with paper and pencil. Once students

were divided, and the essay-based exam was administered on computers, and with paper and

pencil, a small seven-person focus group discussed their concerns with the computer-based exam. Students in the focus group determined that they preferred a pencil and paper based assessment, even before the study was administered. When asked for their reasoning, students reported several negative aspects about computer-based exams. Students found that beginning the writing process what much harder to do when staring at a blank screen rather that when ready and equipped with a pen and paper. Students also reported that the testing environment was disturbed by noise from all of the students typing at the same time. And surprisingly, students have negative views regarding a computer's spell-check capability and found that the red lines that appear under errors disrupted their writing process as they felt the need to immediately fix their errors rather than continue writing (Charman, 2014). A study conducted by Bridgeman, Lennon, and Jackenthal found that students reported the computer screen hurt their eyes when reading and that the glare from the computer screen made it hard to see. The study also found that some students did not prefer large font sizes and that many suffered from an "annoying wait" when moving from one question or screen to the next (Bridgeman, Lennon, & Jackenthal, 2001).

Like researcher Yurdabaken, researcher John Dermo conducted a study where students were prompted for feedback regarding a computer-based testing experience. Although the validity of Dermo's study could have been hindered by having the survey presented to testing participants via email and therefore led to a self-selected sample there was some valuable feedback received. Unlike in Charman's study, students had positive responses to their computer-based testing experience. Undergraduate students stated that the computer-based assessments were expected at the university level, were non-stressful, easily accessible by students, had secure results, valid, and had a high reliability in their marking. The only negative

comment made about the internet-based assessments was that randomized items from question banks were viewed to be unfair (Dermo, 2009).

Students as young as seven years old have also demonstrated preference towards computer-based assessments. Researchers Sim and Horton (2005) investigated the attitudes of twenty children in regards to their experience with computer-based tests and paper-based tests in the subject area of science. Each student in the study was administered both the paper-based and computer-based version of each test. At the conclusion of the assessments, researchers had students display their preference of assessment using a Smarty-O-Meter, which has students place a candy with a Venn Diagram with the sections labeled to be in favor of the computer-based assessment or the paper-based version. In the conclusion of the study, more pieces of candy were placed in the computer-based testing circle by the students (Sim &Horton, 2005).

Effects for Teachers. Like researcher Dermo, another study was conducted with students in the area of ELA and the topic of computer based tests. Wilson, Olinghouse, and Andrada (2014) conducted a study using students in grades 4-8 who took a statewide benchmark writing assessment that was hosted on the computer rather than with pencil and paper. This study aimed to assess whether or not students' performance improved with the assistance of an automated essay-scoring system or AES. The AES system used to give automated feedback to students in this study was called Project Essay Grade. A system such as this can support teachers in multiple ways regarding their grading as well as the completed student work. With the aid of this program, teachers are able evaluate and respond to a piece of student's written work at a much quicker rate than traditional means of grading (Williams, Olinghouse, &Andrada, 2014).

Achievement. Administering assessments using a computer-based format as opposed to using traditional paper-and-pencil examination raises some concerns as to whether or not students will achieve comparable scores using a different mode of assessment.

In the studies of Choi and Tinkler (2002) and Johnson and Green (2006) computer-based test scores were compared to paper-and-pencil based scores in the area of mathematics. Administering assessments electronically in the area of mathematics is difficult due to the amount of work that a student needs to be show in order to illustrate their thought process and solve a problem. To measure the difference in achievement, Choi and Tinkler converted the 2001 versions of both math and reading assessments into an electronic format to administer to students in grades 3 and 10. This study found that students did not perform as well on the computer-based version of their test than the paper-based version. Reasons for this could have been the students' lack of experience on a computer in addition to the assessment writer failing to alter the test questions according to the mode of assessment. Johnson and Green in 2006 chose to also administer assessments in mathematics in order to compare the student achievement for computer-based versus paper-based tests. Analyzing the results of 104 eleven-year-old students after administering the exams in different orders it was determined by the researchers that the mode of administration did not affect student's assessment scores.

Researcher Melody Charman in 2014 looked at student exam results differently when comparing computer-based assessment and paper-based assessment as one of her research questions was, *How does the mode of delivery of a test affect linguistic features of the text produced in terms of quantity, variety and density of vocabulary?* (Charman, 2014). What Charman discovered was that students who participated in the computer-based administration of an English Literature examination wrote more for their responses than their peers did who took

the paper-based version of the examination. Although students who took the paper-based

assessment did not write as much for their responses, their writing used language that was more

dense, however less varied than the writing of a student who took the computer based

examination.

Automatic feedback. Some assessment programs allow for automated feedback to the

test taker. Like Charman, researchers Wilson, Olinghouse, and Andrada looked to examine

student writing quality. The study most specifically looked to uncover if giving a student

automated feedback improves their quality of writing. To complete this study, researchers

reviewed the results of fourth through eighth grade benchmark assessments of 4,162 students

from twenty-eight different schools. In each of the assessments administered to students, there

was at least one essay that needed to be written by each student using the computer. The

automated feedback program that the assessments utilized was called Project Essay Grade, which

provided users with an automated essay-scoring system. While the program aided teachers in the

sense that they no longer had to evaluate, diagnose, and respond to student writing, the program

also benefitted the students in that it gave them automated feedback regarding their written work

and allowed them the opportunity to make revisions during the administration of the assessment.

The study found that the students who utilized the automated feedback given, did in fact make

revisions to their writing and therefore made minor gains in their quality of writing during the

assessment (Williams, Olinghouse, &Andrada, 2014). Students also have demonstrated that they

enjoy their experiences with online testing due to the automatic feedback, and report that because

they can receive the scores the same day the results are more meaningful to them (Schaffhauser,

2011).

Administration Concerns for Schools. Computer-based high-stakes testing is quickly making its way into schools and it is critical that schools and districts are ready to take on the challenge of administering these assessments. Brett Frazier the developer of learning platform Blackboard says, "Mobile technology in schools is not going to happen- it is happening" (Eisele-Dyrli, 2011). From a Technology Coordinator perspective, the researcher insists that one of the first steps that schools should take is to inventory the number of eligible devices that they have as a building in comparison to their student population in order to gauge how many days of testing that they may need schedule for in order to accommodate all students in addition to determining if they need to purchase more devices for student use in their school building. Schools must also look to assess their bandwidth strength, which can be a pricey yet necessary challenge. If a school's bandwidth is not strong enough, the Wi-Fi connection in the school building will not be able to handle all of the test takers utilizing the internet at the same time. Another obstacle for schools is determining how to control student access on the screens of their devices. It is important to limit what students are able to view during the assessment procedure in an effort to lessen the odds that students will deviate their screens away from the test, which may include external websites and even calculators. The day of the assessment administration, it will also be crucial for schools to be staffed with an adequate IT team in order to troubleshoot any problems that may occur (Schaffhauser, 2011).

Ideal Testing Situations. As the tests begin to be more widely used, patterns in ideal testing situations can be uncovered. Before administering a computer-based test to a student, it is important to ensure that the student has a strong computer background and training in taking online or e-assessments on the device in which they are being assigned to use for the test. If a student is uncomfortable with basic computer skills such as clicking with a mouse or touchpad,

scrolling down a page, or typing out a response item then they will not complete the assessment successfully (Parshall, 2002). Even in younger grades, computer and mobile device instruction should be incorporated into the curriculum in order to better prepare students for the device utilization that they will encounter in the upcoming years of their school career.

Before administering computer-based tests to students it is also highly recommended that students are given the opportunity to become familiar with the test administration method that will be used (Kingston, 2009). If a student is unfamiliar with the format of a particular testing program, they are less like to achieve a score to their fullest potential.

The number of items and how they are displayed are other components to explore when developing and designing computer-based assessments for students. When it comes to easily distracted test takers, it has been seen as ideal to only display one test item at a time on the screen. By doing so, the student is more likely to focus on the question being asked and is less likely to make an error when attempting to answer the question. The number of questions on a computer-based exam is also something that exam writers should put thought into as students test more positively on examinations with few test items than they do when exams are longer in length (Parshall, 2002).

No matter how well trained on the computer or how carefully thought out the test creator developed the exam, students will never be completely comfortable with all computer-based assessments that come their way due to no one universal testing software among assessors. Before the beginning of a computer-based assessment, there should be explicit directions for test takers. Before students begin answering test items, there should also be several example items in order for the students to become familiar with the test format and ask any necessary questions

before continuing on to complete the questions that count towards their final assessment score

(Parshall, 2002).

Devices

Carolyn Foote, a past presenter at Internet @ Schools says, "It can't just be about the

dazzle of the device. It needs to be about what the device helps students and teachers do better"

(Foote, 2010). Foote certainly raises a good argument; devices should not be placed in the hands

of students simply because they are the hottest item on the market. Teachers first need to have a

vision of what the devices will do to improve classroom instruction and assessment before any

major purchasing takes place.

One major factor that varies between different electronic devices is screen resolution and

screen size. In 2001 researchers Bridgeman, Lennon, and Jackenthal looked to evaluate the

effects of variations of screen size, resolution, and presentation on test performance. To test the

effects a sample of 357 college bound high school juniors were asked to take a computer-based

version of an SAT examination in the verbal and mathematics areas using three different display

conditions in regards to screen size and screen resolution. Researchers claimed that screen

resolution was a critical variable when administering a test on a computer. A computer with a

higher resolution will allow for more words to be displayed per line in addition to displaying

more lines per screen. This study was able to conclude that the size and resolution of the screen

was able to make a difference in the achievement of students in the area of reading

comprehension however it could be suggested that the resolution of the screen could be more

important than the size of the screen (Bridgeman et al., 2001).

Researchers Davis, McBride, and Kong recognized that with the increase of technology

used in schools raised the question as to whether or not all devices are considered to be created

equal in regards to how students use them to take an online assessment to demonstrate their

knowledge. These researchers then conducted a study to investigate this question by having 954

students from five different Virginia high schools take an exam on either a laptop or desktop

computer all of different models. Regardless of the testing platform, students were placed in the

same room while taking the test with partitions in between the test takers. Students then took a

59-item test divided into three sections covering the major tested content areas including reading,

mathematics, and science. While the study found that there were no significant differences in the

scores between devices they did find that students have a preference for using devices that they

have more experience with when using them for testing purposes as revealed in a survey at the

conclusion of the study (Davis, Kong, & McBride, 2015).

> Classroom testing may involve students experiencing assessment materials on desktop
>
> and laptop computers as well as tablets, moving interchangeably between devices.
>
> Students should not be required to learn an entirely new interface when alternating
>
> between devices and should be able to transfer their knowledge and techniques from one
>
> device to another. (Seymore, 2013, pp. 24)

With this in mind, schools often purchase a variety of devices however it is important that the

students are familiar will all potential testing devices in the building. Desktop computers, Apple

iPads and, tablet devices such as the Microsoft Surface Tablets are all likely devices used within

schools to enhance course work but to administer local and high-stakes tests as well.

Desktop computers. In general, students still receive most of their computer instruction

on desktop computers. From the very basic skills such as mouse control, keyboarding, and word

processing, these devices are used to instruct basic computer skills to students. With this in

mind, students are generally very confident when using desktop devices for educational

purposes. While students may find this testing device familiar and comfortable due to its external mouse, large keyboard, and large screen there are some downfalls to using desktop computers in the online testing environment. First, it is important to note that desktop computers are stationary, which means that if a teacher is going to give an online assessment to students it will need to be done in the confined space of a computer lab, whereas with tablet devices or laptops, teachers are able to easily move equipment throughout the school building.

The lack of security is also an incredible downside to using a desktop computer for online testing. Unless the school purchases additional software to enable their computers to be locked down to specific programs and pages, certain actions taken by the student whether accidental or purposefully could navigate them away from the testing environment (Seymore,2013). One program a school could use to lockdown internet browsers during assessments is called *Respondus*. The custom browser would allow teachers to easily lockdown their online-testing platforms such as Blackboard, ANGEL, Moodle, and Schoology in order to disable students from deviating from the testing screen. This lockdown would create a computer experience where students would be unable to access other applications, navigate to other websites, print or even copy until the student has submitted their assessment for final grading. While a customized browser with lockdown features seems like an ideal scenario for educators who utilize computer-based assessments in their classrooms, it does come with a price. *Respondus* not only requires a one-time registration fee but it also requires an annual fee of $1695 for a school or district with under 2,500 and obviously increases in price for schools with larger numbers of students (Respondous, 2016). For large districts with substantial budgets, this may seem like a small price to pay for a valuable tool however, for a smaller school or private school working with a minimal budget, this software is simply out of reach.

Touch Screen Tablets. Many tablet devices such as the Microsoft Surface, as well as the Apple iPad are equipped with an on-screen keyboard feature, however users have the option to either use the provided on-screen keyboard or purchase an external Bluetooth keyboard. A study conducted by Strain-Seymore, Craft, Davis, and Elbom test how students responded to the use of both keyboards while taking the Virginia Standards for Learning (SOL) field test on electronic devices in the area of writing with the use of a Samsung Galaxy Tab tablet. This study utilized twenty-four students from two different Virginia school districts in grades, four, eight, and unspecified high-school years. Of the two school districts represented in the study, one school district frequently used Apple iPads or iPods for instruction and assessment while the other did not, however all students who participated in the study had used this particular testing interface in the past. At the beginning of the writing intensive assessment students were prompted to conduct their typing using the provided on-screen keyboard. During the course of the test students were given the opportunity to begin by using the on-screen keyboard and end using the external Bluetooth keyboard with the features of auto-complete, auto-capitalize, and auto-correct disabled during the duration of the assessment (Seymore, 2013).

Due to students being tested on a one-on-one basis, during the course of the examination researchers asked that the students do their thinking out loud in order to voice any difficulties that they may be having while testing on the devices. The most common reported usability issue among test takers was that the buttons, controls, or on-screen icons were often smaller or close in size to their fingertips which caused frequent problems when trying to make testing selections. Students also commented that the touch screen tablets lacked precision when students would attempt actions such as highlighting, circling, or underlining specific words or phrases on the assessment and students often would try several time to make the correct selection however

would give up expressing that the incorrect selection was close enough. The interaction between a touch screen and a student's fingertips also affected how students were able to fix their errors. Students expressed that when trying to fix errors it was difficult to place the cursor with their fingertips and so they would often need to delete whole sentences to make one correction. Students also reported the frustration of having to touch a button more than once to make a selection before seeing any effect when the screens seemed to be unresponsive (Seymore, 2013).

In regards to keyboard differences, students were able to give researchers some notable feedback to be used by future computer based-test administrators as well as school technology coordinators. Student's keyboarding was reportedly slower when using the on-screen keyboard than when using the external Bluetooth keyboard. Older students reported that the on-screen keyboard would take some getting used to and displayed frustration when first using it. When using the on-screen keyboard, students reported that the keyboard covered up half of the essay that was currently being typed which made it difficult when monitoring their progress and going back to proofread their writing. Some students acknowledged that after using the on-screen keyboard that the use of the external Bluetooth keyboard actually created an awkwardness. Although some students reported that the small size of the external keyboard felt cramped it was still more preferred as to the on-screen keyboard. Interestingly the study found that younger students were observed to have less problems with the on-screen keyboard when creating capital letters than when creating capital letters with the external Bluetooth keyboard. Although these younger students were able to navigate creating capital letters with ease on the on-screen keyboard, the same younger test takers needed the assistance of the proctor when trying to find the numbers and symbols on the keyboards (Seymore, 2013).

Microsoft Surface Tablets. The Microsoft Surface Tablet was released in 2012 with

their first-generation device and is now currently marketing their Surface 3 version. The features

of this device are like a tablet but also very similar to a laptop in that it has the same Microsoft

Windows navigation appearance as well as the option to attach a keyboard paired with a

touchpad similar to that of a laptop. The major differences between this device and a laptop is

that the screen is significantly smaller at 10.8 inches with a resolution of 1920x 1280 and an Intel

® Atom ™ x 7 processor along with touch screen capabilities.

As reported by Schaffhauser, if a student is using the touchpad for navigation they may

experience frustration in the absence of using a computer mouse due to the level of dexterity in

which it takes to position a cursor in its desired location using a touchpad. However,

Schaffhauser also pointed out that if a student is using their finger of the screen of a device they

are also more likely to have their hand interfere with their view of the screen when attempting to

make a selection (Schaffhauser, 2012). With this in mind, it is possible that students will not find

navigating the Microsoft Surface Tablet an easy task as opposed to navigating a regular desktop

computer.

Although researcher Powers and Potenza completed a study in 1996, long before the time

of the Microsoft Surface Tablet, they did uncover some information that may be helpful when

determining the best devices for schools to purchase for the purpose of Computer-Based Testing.

Powers and Potenza conducted a study using 201 graduate students as they took an abbreviated

form of the GRE writing portion. To complete this portion of the exam students wrote sample

essays on both laptop and desktop computers. At the end of the study, students revealed

complaints about using the laptops to conduct their written responses in the form of a

questionnaire. A major complaint among the students was that the laptop keyboard was too

small leaving the keys too close together resulting in the unfamiliarity with key location and the increase of errors. Another complaint among students was that the screen on the laptop was too small and therefore lacked clarity (Powers& Potenza, 1996). In regards to the keyboard student complaint, the keyboard on a Microsoft Surface Tablet is even more condensed, is it possible that students will report the same difficulties with today's newest technology?

Apple iPads. Different from desktops, laptops, and netbooks Apple released the iPad in 2010. Upon its release, educators saw its potential for use in the classrooms and soon iPad pilot programs began to kick-off in schools all over the country along with supporting webinars, professional development resources, and conference workshops aimed toward making the most of the groundbreaking educational technology (Eisele-Dyrli, 2011). Apple has numerous editions of the iPad however if looking at the iPad Air, currently the best priced full size iPad on the market, the device is sized with a 9.7-inch retina display and a resolution of 2048 x 1536.

As a popular handheld device in the classroom, iPads can be used for a variety of educational purposes including research, notetaking, camera and video projects, and uncountable available applications with the purpose to enhance educational content. With such a powerful device in the hands of young students, it can be extremely valuable to be able to control a student's screen in order to keep them on task. With the release of Apple Software iOS 6 teachers were able to control student's devices with a setting referred to as Guided Access. This allows teachers the ability to lock a student's screen on a specific applications or webpages by pressing the home button on the iPad three times and then using a passcode to disable and enable the Guided Access feature. Guided Access also allows teachers to disable Apple iPad features such as spell check, screen sleep, and motion rotation (Al-Ali, 2015).

Marielle Patronis conducted her study on using iPads to assess student performance in 2014 using 77 college composition students. The students involved in the study took the assessment and then completed an on-line survey at the conclusion of the assessment regarding their iPad learning experiences and perceptions.   Test scores were analyzed and survey responses were converted to a Likert scale to uncover the following conclusions. Thirty-nine percent of the participants had no significant difference in test scores, nineteen percent of participants performed better with the use of the iPad, and a surprising forty-two percent of participants received lower scores with the use of the iPad. The reasoning given for the lower test scores obtained by students was attributed to the fact that the Apple iPad does not allow its users to view more than one window at a time. Limited visibility made it difficult for students to be sure that they were answering the writing prompts accurately as they could not view the passage that the question was referring to while formulating their response. In an effort to overcome this challenge many students attempted to copy and paste text and then manipulate it, which ended up causing numerous errors. Although students were presented with challenges in this study, and test scores revealed to be in favor of the pen-and-pencil version of the exam, most students still perceived the iPad as a valuable educational tool that helped them perform better in their reading and writing comprehension (Patronis, 2014).

Questar

Questar Assessments is a company based out of Minneapolis, Minnesota and is a contributing member of the IMS Global Learning Consortium whose mission is to advance technology in a way that improves educational attainments and participation. As a member of the IMS Executive Board on Assessment, Questar is committed to creating an assessment architecture that enables the growth of computer-based testing worldwide (PR, 2015).

Recently, in an effort to transition to using computer-based tests to measure their

student's performance, New York State has chosen Questar to develop its assessments for

students in grades three through eight, a position that was previously held by the educational

company Pearson. Questar's assessments are projected to be shorter in length, have teacher

influence in their development, and be administered on the computer (Harris, 2015). Computer-

based assessments will begin being administered by New York State beginning in 2016 in the

form of voluntary field tests developed by Questar, which will be administered to students in the

content areas of ELA and Mathematics between the dates of May 23, 2016 through June 10,

2016 (NYSED, 2015).

Questar Assessments will be administered through the online platform referred to as

Nextera, which has been designed to provide its users with a reliable and easy to use assessment

system with individual student and teacher logins and many beneficial features. Not just any

computer device will be able to host the Nextera assessment platform and there are many

requirements that systems must meet before launching an assessment. A basic table of device

requirements is listed in the table below.

Figure 1.
Questar Technical Requirements

If Questar test administrators are still unsure about which devices are eligible for the assessment they should turn to the system readiness page on Questar's public website https://www.questarai.com/ which offers the opportunity to run a System Scan in order to determine if the computer device meets the technical requirements for testing. Test administrators should also consult the Test Readiness Check tool located on the same page as the System Scan in order to obtain feedback regarding the available bandwidth for testing. When additional information is entered into this tool, the program will determine if the available bandwidth will be able to handle a certain number of students testing at the same time.

Before the official test date, the Nextera testing platform allows for students, teachers, administrators, and parents to view and complete a sample test in order to gain experience with the format, testing tools, and the accommodations that can be made for students. By giving the schools a chance to view and experience the test they can also be sure that on the testing day the test will load properly within a browser that is secure from all other distractions.

It has been noted by Parshall in 2002, students are discouraged by computer-based tests due to their inability to interact with the test as they would be able to with a paper-based exam in regards to highlighting, underlining, taking notes in the margins, and eliminating known wrong answers. In response to this deficiency in computer-based testing, tests taken using the Nextera platform allow students to use various tools in order to better interact with their assessment. Tools in which students have access to include a highlighter, ruler, calculator, notepad, zoom, and the ability to eliminate wrong answers, as well as flag or skip a test item. Using the Nextera testing platform students do not have to worry about accidentally skipping a question on the test without answering it because before the student is able to submit the assessment for review they are shown a table which allows them to see which questions they have answered, skipped, flagged, or have marked with a note.

After reading Questar's publication of their CBT Readiness Meeting notes the researcher found that Questar's Nextera testing platform makes it very easy for the teacher or test administrator to apply individual student testing accommodations with just a click of a mouse. Student accommodations that can be made for these assessments include an answer masking tool, screen reader, reverse contrast, change in background color, and magnification (Questar, 2015). The accommodations that the Nextera testing platform by Questar can offer students will have a significant impact on the way that students with disabilities take state tests.

On the day of the assessment, students will log in to their devices with individual login information, which can easily be printed by the teacher or test administrator for student distribution. Over the course of the test, the teacher or test administrator is able to view the student progress within the class and start and end times have the ability to be recorded within the testing platform. Due to the security features of the Nextera testing platform students are placed in a secure testing environment which allows students to stay focused on the test, free from interruptions, all without an additional browser or software to download (Questar, 2015).

Research Question

The above literature review reflects on the shift of computer based-tests from pencil – and-paper examinations. As a shift toward computer-based testing takes place it can be expected that many more studies that involve the comparability of different computer devices will surface over the next several years (Seymour, 2013). Over the next few years, paper-based testing will be phased out and taken over by computer-based assessments. In order for schools to be confident in administering these assessments to students, they will first have to do their own research as to what devices will be the most useful and comfortable for their students.   However, when implementing these devices in schools for the purpose of computer-based testing it is important to properly train students on each of the individual devices and allow them to practice using various devices features before using them to deploy assessments. It is also important for schools to remember that if students are going to be expected to use mobile devices and computers in the classroom it is important for teachers to have thorough training on each of the devices in order to use them as classroom tools in the appropriate way.

Research Question: **What computer device are most favorable to students when administering computer-based assessments?** The research question will be answered by the

researcher conducting a study using seventh grade students taking the Questar ELA pilot

assessment on June 3, 2016. While administering the test to students the researcher will divide

the students into three test groups in order to compare the usability of different computer devices

in a CBT assessment environment such as Questar's.

Methodology

Step 1: Author's Background

The researcher is the Computer Teacher and Technology Coordinator in Amherst, NY at private Catholic institution named Saint Benedict School serving students in grades Pre-Kindergarten through grade eight. The school itself is rather advanced in terms of classroom technology due to their STREAM (Science Technology Religion Engineering Arts and Mathematics) Initiative. The STREAM Initiative is utilized throughout most of the Catholic Schools in the Buffalo Diocese in order to build bridges between core subject areas that will prepare students as 21st century learners for their futures in the workforce while using their Catholic faith as a foundation (WNY Catholic Schools, 2016). Similar to well- known STEM (Science Technology Engineering and Mathematics) programs, the school administration encourages technology to be used in classrooms whenever possible. Due to the importance of technology in the school, it is the job of the technology coordinator and researcher to make sure that the school has the latest classroom technologies it needs to provide students a quality education.

Step 2: Identifying a Research Topic

In the process of identifying the research topic, the researcher had several different topics in mind before settling on the present topic of research. The first topic that the researcher wanted to explore was the CCSS and parent opinions. After doing research on this topic for a few days the researcher determined that the topic of CCSS is too controversial with parents and that many parents are also misinformed which would be a major limitation.

In recent years, based on NCLB, CCSS, and RTTT, it is clear that computer-based testing is going to take over traditional paper-based testing in the realm of state assessments. Knowing

that it was the researcher's job as the school's technology coordinator she decided that it would

be beneficial to pursue research related to computer-based testing. The researcher then began

reading articles about computer-based testing versus paper-based testing. With research

collected, and a literature review started on this topic, the researcher began to find that very little

research found that there was a difference in student scores between computer-based and paper-

based tests. With this in mind, the researcher realized conducting a study that compared the

difference in student scores between computer-based assessments and paper-based assessments

would not uncover any new knowledge.

With a literature review already started on the topic of computer-based testing the

researcher needed to find a related topic of research. In the researchers current position as a

technology coordinator one of her upcoming tasks was to purchase new devices for the school

building to accommodate computer-based testing requirements in the upcoming years. The

researcher then settled on the research topic of computer-based testing devices.

Step 3: Identifying a Problem

At the beginning of the research process, the researcher felt that the problem she was

looking to uncover an answer to was whether or not students performed as well on computer-

based tests rather than traditional paper and pencil based exams. Through analyzing several

articles and beginning to a write a literature review about this topic, the researcher came to the

conclusion that all of the articles led to the same conclusion. In general, students did not perform

any differently on computer-based assessments than they do on paper-and-pencil based

examinations (Johnson & Green, 2006), (Yurdabaken, 2012), Ling & Bridgemen, 2012).

Because of this, the researcher decided that a different problem needed to be addressed.

Soon after coming to the conclusion that the research problem needed to be changed, the

researcher received an email from her administrator at Saint Benedict School stating that they had been signed up to complete a computer-based testing pilot study for the NYS ELA assessment. Immediately after receiving the email, the researcher met with the principal and explained that data valuable to the school could be uncovered in the process of this pilot study.

In the weeks prior, the researcher had been approached by her administrator asking what devices should be purchased for students to create a one to one device model within the school in order to accommodate future computer-based testing mandates by the state stating that all 3-8 assessments will be administered on a computer by the year of 2020 (NYSED, 2015). While iPads, desktop computers and Microsoft Surface Tablets are all currently used by students the researcher felt as if there really was not any hard evidence about the feasibility and usability of devices already being used at Saint Benedict School. Feeling conflicted, the researcher proposed to the principal that the problem of what computer devices are the most useful when conducting high-stakes testing such as the New York State ELA Assessment could be addressed during a pilot study led by this researcher as part of her Master's thesis.

Step 4: Conduct a Literature Review

The researcher began searching for articles to review starting in EBSCO Host using the search terms Computer-based testing, achievement, paper assessment, student attitudes, tablets, assessment, and testing. Once the researcher gathered information from that first collection of EBSCO Host found articles, she began to look through the Reference section of each of the articles that seemed to be most relevant to her intended study. The researcher then began to find articles that seemed to be most valuable from other researchers work using EBSCO Host as well as Google Scholar. Once the researcher found and read her articles, she began to go through the

same process of going through the reference section of the different studies to track down additional information about her research topic.

Step 5: Overview of the Research Design

      Research question. In order to solve the problem the researcher needed to develop a research study in order to answer the question, *what computer device is most favorable to students when administering computer-based assessments?*

      Sample. To answer the research question the researcher needed to identify a sample group of students. As the computer teacher at Saint Benedict School in Amherst, New York, the researcher felt that it would be best to utilize her own students. Saint Benedict School is a small Catholic education institution serving students in grades Pre-kindergarten through eighth grade.

      Methodology. This was a comparative analysis across three groups of students, each receiving different treatment. Student perception was documented using the following data collection strategies: observation, interview and questionnaire. While administering the pilot Computer-Based English Language Arts Exam (Questar, 2015) the researcher circulated the room taking observational notes about the pacing at which students were working, any frustrations that they seemed to be having, and overall ease of navigation that the assessment had for each device. After students finished the ELA assessment, the researcher then presented each student with a questionnaire that allowed them to rate the device in which they used and to give feedback on their overall experience. Once all surveys had been collected, the researcher then interviewed two to three students from each experimental group individually. In the interview, the researcher recalled information from her observational notes and discussed certain behaviors that the students displayed and their reasoning for those behaviors.

Treatment. During the computer-based testing pilot study, all students took the test in the computer lab due to the desktop computers lack of mobility. Having all students test in the same location allowed the researcher to collect observational data for all students simultaneously. Eight students took the assessment on desktop computers, three students took the test on an Apple iPad, and the remaining four students took the assessment using a BAK USA Atlas 10 device, although these students were originally to test on the Microsoft Surface Tablet. In order to group the students, the researcher worked alongside the ELA teacher to devise groups in which students of both higher and lower achievement were spread out equally in order to get the most reliable results on each device.

Outcome measure. The outcome measure used in this study was a sample test based on the seventh-grade New York State English Language Arts exam developed by Questar.

Step 6: Identifying the Student Test

At the beginning of the school year, the principal signed students up to participate in a computer based-testing field test based on the NYS ELA exam. With the need to identify devices that should be purchased in order to comply with computer-based state testing requirements in the upcoming years the researcher suggested to the principal that several devices should be used by students taking the test in order to understand which devices are most preferable to students. The NYS assessments have been created by a new company for the 2015-2016 school year by the name of Questar. Questar assessments utilize their own testing platform by the name of Nextera, which allows students to test in a secure environment with necessary accommodations, and test related tools.

Step 7: Identifying a Framework

Previously New York State had an assessment contract with Pearson and therefore was following the PARRC Assessment Framework. As of 2015, the State will have Questar responsible for their state level exams for students in grades 3-8 (Harris, 2015).

Questar assessments. The researcher followed Questar's computer-based testing guidelines in order to administer the test. During the month of April, the researcher reviewed the Questar testing guidelines for devices in order to determine which devices have the capability to accommodate the computer-based tests. The researcher then looked at the internet browser requirements for each of the devices and arranged to update all browsers during the first week of May if necessary.

Nextera testing platform. The researcher also prepared students for the new testing platform as suggested in the Questar Assessment and CBT Tech Readiness Presentation (Questar, 2015).   The presentation suggested that before administering the test to students, students should be given the opportunity to log in to the Nextera platform in order to be sure that their usernames and passwords are valid. Giving students the opportunity to use the Nextera testing platform also allows the students become familiar with any necessary accommodations that they may need as well as the tools that they will be able to use during the assessment.

Step 8: Identifying Equipment

Desktop Computer. The first device chosen for this study was a desktop computer. At this particular school where the study was conducted, students take computer classes starting in Preschool once a week through second grade. Once students reach grades three through five students participate in computer classes twice a week. And once students reach middle school they take computer classes four days a week for ten weeks in a school year. Although the

computer lab had a variety of models available to the students, the researcher wanted to ensure

that students using the desktop computers all were able to use the same models of computers,

screens, computer mice, and keyboards. To ensure this, all students testing on desktop

computers used Dell Optiplex 790 machines with 19-inch Dell monitors with a resolution of

1400 x 900.

Microsoft Surface Tablets. Students at this school also utilize Microsoft Surface Tablet

devices in their general education classes. Seventh grade students have had access, training, and

experience with these devices since the previous school year. The school building has two

different models of the Microsoft Surface Tablets including the Surface Tablet 2 and the Surface

Tablet 3. Due to being newer and more reliable, students in this study tested on the Microsoft

Surface Tablet 3, which has a screen size of 10.8 inches and a resolution of 1920 x 1280. Due to

unforeseen software issues student were unable to test on the Microsoft Surface Tablets and

instead needed to test on a pilot device that the researcher happened to have access to in the

building as the technology coordinator. At the time of the study students have been trying out

the BAK USA Atlas 10 devices in their classrooms. This device is essentially a 10-inch netbook

equipped with a full keyboard as well as a touchpad and stylus for navigation in addition to touch

screen capability. Due to a limited time frame to complete the study the researcher chose to test

a group of students on the BAK USA Atlas 10 devices in place of the Microsoft Surface tablets

Apple iPads. Students in this study also utilized Apple iPads of the Air model to take the

assessment. This group of students had also been given the opportunity to use these devices in

the classroom however; their experience with them is less intensive than of the Surface Tablet

and desktop computer. The Apple iPad Air has a 9.7-inch screen display and a resolution of

2048 x 1536.

Step 9: Identifying the Sample

When the researcher realized that only seventh grade students at Saint Benedict School were previously arranged by the prior principal to take the computer-based field-test in June of 2016, this became her sample. The student sample used for the study have taken computer classes with the researcher for twenty weeks in the past two school years and therefore the researcher believed that the students would be comfortable participating in her research study regarding testing devices. The seventh-grade class during the 2015-2016 school year at Saint Benedict School consisted of twenty-two students. Of the twenty-two students, 19 were considered Caucasian and three African American. The seventh-grade class consisted of students off all different ability levels. Of the twenty-two students, three of them were considered to be advanced in the content area of ELA, five received tier two interventions in the area of ELA, and one of the students received tier three interventions in the area of ELA.

Step 10: Creating a Post Assessment Questionnaire

After reviewing many studies regarding computer-based testing a variety of questions were able to be selected in the current study for the implementation of the questionnaire after the assessment. The following table identifies the questions that students will be presented with in the questionnaire.

Table 2.
Student Questionnaire Questions

Question	Citation
How many years of your school career have you attended computer classes? 7 or more years 4-6 years 2-3 years 1 year or less	Kashino (current author)
How many hours a day do you spend on average on a computer of mobile device for school? None One hour or less Between one and three hours Three hours or more	(Ling &Bridgeman, 2013)
How many hours a day do you on average on a computer or mobile device for pleasure? None One hour or less Between one and three hours Three hours or more	(Ling &Bridgeman, 2013)
Which of these devices do you use regularly for personal or recreational use? Select all that apply. Desktop Laptop Microsoft Surface Tablet iPad Smart Phone None of the choices	(Davis, Kong, & McBride, 2015).
Which of these devices do you use regularly for school work? (Select all that apply) Desktop Laptop Microsoft Surface Tablet iPad Smart Phone	(Davis, Kong, & McBride, 2015).
Before today, which of the following have you EVER used to take a test or quiz? Paper Desktop Laptop Microsoft Surface Tablet iPad Other	(Davis, Kong, & McBride, 2015).

How do you feel about the following methods of device navigation?
 	
Touch pad (as used on a laptop or Microsoft Surface Tablet)
        Dislike   Neutral   Prefer
 	
Mouse
        Dislike   Neutral   Prefer
 	
Fingertip (Touchscreen)
        Dislike   Neutral   Prefer
	(Bridgeman, Lennon, & Jackenthal, 2001).

Using the electronic device make it easier for me to write Strongly Agree Agree Neutral Disagree Strongly disagree	(Patronis, 2014)
Which of the following devices did you use today to take the test? Desktop Computer Microsoft Surface Tablet Apple iPad	
Describe your likes and dislikes of your experience today testing on an electronic device as opposed to paper.	(Davis, Kong, & McBride, 2015).

Step 11: Identifying Guiding Interview Questions

Intended interview questions were developed by the researcher with the intention of revealing more detailed information about the student experiences that would be too lengthy to ask in the questionnaire. The researcher will be looking to ask students the following questions in the interviews in addition to any topics that the student brings up.

Table 3.

Student Interview Questions

1.	*I noticed during the test that you_____ can you explain why?*
2.	*Do you feel you performed better or worse on the test today than you did on the paper version in April? Explain why?*
3.	*If you were expected to take a test like this in the future on the computer, what would be some suggestions you have to make the experience better for you?*
4.	*What did you like about your test on computer/ iPad/ Microsoft Surface Tablet today?*
5.	*What didn't you like about your test on the computer/ iPad/ Microsoft Surface Tablet today?*
6.	*Do you feel using (name of device) during testing is fair? Why or why not?*

Step 12: Identifying the Time, Date, and Location of the Study

Table 4.

Schedule of Study Implementation

	Time	Portion of the Study
	12:40-1:20 pm	Administration of Questar ELA exam and observational notes made by the researcher. Students may complete the questionnaire upon finishing their exam if time allows.
The proposed study will be conducted entirely on the date of June 3, 2016 in the Saint Benedict School Computer Lab	1:20-1:30 pm	Extended student questionnaire time if needed.
	1:30-2:00 pm	Researcher will review observational notes and student questionnaires to determine which students will be interviewed.
	2:00- 2:40 pm	Researcher will conduct student interviews.

The researcher was informed by the principal that the computer-based field test must be conducted between May 25, 2016 and June 10, 2016 and that as the technology coordinator that date of the test was at the researcher's discretion. In order to allow time for HSR approval and a window of time in the event of a testing delay, the researcher chose the date of June 3, 2016 to conduct the study. The specific date was chosen due to the absence of a group of Middle School students who would be out of the building on a field trip that day. By having this group of students out of the building the researcher can ensure that there will be minimal student traffic outside where students commonly use the desktop computers.

Recognizing that the seventh-grade ELA teacher would also need to be in the room during the administration of the assessment the researcher needed to consult the teacher on what time of day would fit best in her teaching schedule. Between the researcher and the teacher, it was declared that students would take the assessment after their lunch period starting at 12:40 pm. The administration of the test was scheduled to conclude at 1:20 giving students forty minutes to take the assessment.

Step 13: Run System Scan

Once the devices and browsers were verified to be compatible, the researcher began to run system scans on all testing devices during the first week of May. The system scan provided on the Questar webpage works to ensure that the devices would meet the technical requirements for testing.

Step 14: Run Test Readiness Check

In an effort to be certain the school's internet bandwidth was running sufficiently, the researcher ran the Test Readiness Check tool during the second week of May. The tool is designed to give the test administrator feedback in regards to how many devices can be used to

test students simultaneously using the available bandwidth. The tool revealed that in fact the school's bandwidth was capable of handling the computer-based tests on the date of the study.

Step 15: Applying for HSR Approval

Due to the need for the researcher to conduct the study during the same school year of her thesis proposal class, the HSR proposal writing needed to be expedited by the researcher in order to be sure that the researcher had the approval for the study to be carried out. On May 9, 2016 the Fredonia State University released the letter stating that the researchers HSR application had been approved for the following June study.

Step 16: Writing Letters to Students and Parents about Participation

Once the researcher gained HSR approval she needed to develop letters to be sent home to students and parents in order for them to participate in the study. Once the researcher had received HSR approval the researcher gave a copy of the consent letters to the principal. In an effort to assist the researcher, the principal copied the consent forms and dispersed them to the seventh-grade students. Unfortunately, when this was done an error occurred and two student forms were sent home with students instead of one student and one parent consent form. On the date that the letters were sent home to students the researcher also sent an email copy of the consent forms to parents. After receiving feedback back from the parents about the wrong form going home the researcher needed to print new consent forms to go home with the students for the parents to provide their consent.

Step 17: Students Tried the Testing Platform Prior to Study Date

In the preparation framework that Questar provided tests administrators, it is recommended that students try the testing platform before the day of the test, to be sure that students are able to log in and that the test appears as it is intended to (Questar, 2015). During

the third week of May the researcher arranged with the seventh-grade ELA teacher to have all

the students come to the lab during their ELA period to practice logging in to the Nextera

platform, using the available tools, and overall becoming familiar with the layout of the test all

while making sure that there are no errors in the testing display. At this time, all students were

seated at a Desktop Computer in the school's computer lab and lead by the researcher to the

Questar testing site. Once students had selected their appropriate grade level and subject the

researcher explained each of the testing tools to students including the highlighter, notepad,

zoom, and marking tools. Students were then asked to complete the practice test questions that

were presented on their screens. The researcher asked that students remain quiet at this time and

raise their hand if they had any questions about the tools and functions within the Nextera

platform. Students used this time wisely to ask many questions related to the tools and functions.

Step 18: Installing Questar Testing Software

The week of the study the researcher needed to install the Questar Assessment software

onto the testing devices. The first device that the researcher added the testing software to was

the Apple iPad Air. The researcher found that this was a very simple installation process as the

Questar Assessment Application was found in the iTunes App Store for a free download.

Next the researcher began to install the Questar Assessment software on the desktop

computers in the school's computer lab. The researcher found this installation process to be

much more complicated than the download for the Apple iPad Air. In order to download the

software, the researcher first needed to log into the Nextera system as a test administrator to

obtain the testing application file for download. As a way to expedite the installation process of

the remaining devices the researcher put the Questar Assessment installation software on a flash

drive in order to easily transfer it from computer to computer.

Once all desktop devices had successfully installed the testing software the researcher began the process of downloading the same application file to the Microsoft Surface 3's that the students would use for testing. At the time of installing the software it seemed as if all devices would be ready on the day of the study.

Step 19 Set up the Testing Room

After holding the researchers morning computer classes, she began setting up the computer lab for the study involving seventh grade students. Once devices were set up and powered on the researcher began to open up the testing software for the students. When attempting to open the testing software on the Microsoft Surface Tablet 3's the researcher noticed that the software would not open on any of the devices. The researcher knew that the study needed to have students split into three test groups and unfortunately the Microsoft Surface Tablets were not going to be available for student use.

Coincidentally the researcher was participating in a pilot program of another classroom device called the Atlas 10 made by local Buffalo, New York company BAK USA. The Atlas 10 is a 2-in-1 tablet/ laptop hybrid with an attached stylus as well as a touchpad to assist with navigation other than with the use of a fingertip. With nearly a half hour before the students were ready to walk in the door to participate in the study the researcher made the decision to implement the Atlas 10 devices. To the researchers surprise the Altas 10 did not have a USB port for the flash-drive that contained the Questar testing software. What the Atlas 10 did have however was a Micro SD card port. The researcher needed to act quickly and find a Micro SD card as well as an adapter to transfer the software file to the USB flash drive. With less than five minutes to spare before the students entered the room the researcher finally had installed all testing software and all devices seemed to be functioning appropriately.

Step 20: Conduct the Testing Study While Taking Observational Notes

All twenty-one students asked to engage in the study entered the computer lab on the

testing date and sat at their designated devices as decided by the researcher and the English

Language Arts teacher in order to carefully distribute students according to English Language

Arts skill and student Individualized Education Plans (IEP's). Students were given their log in

information and were instructed to enter the Nextera testing platform. This process was delayed

fifteen minutes due to unforeseen complications of logging students in correctly and pairing

keyboards to the iPad Air devices. Once the researcher realized that fifteen minutes had been

lost she made the decision to dismiss the students whose electronic devices were not ready to test

from the room in order to prevent any additional distractions in the testing room. Of the students

who remained in the room to participate in the study included eight students on the desktop

computers, three students on iPads, and four students on Atlas 10 devices for a total of fifteen

participants.

Once students were able to begin testing, the researcher circulated the computer lab

observing for any signs of struggle and student test taking strategies. Other studies have found

different typing rates between different devices, confusion of where keyboard keys are located,

struggling students using their fingertips to navigate a screen. Observational notes can be found

in Table 6. The researcher then used the observational notes to guide interview questions in the

latter half of the study.

Step 21: Collect Student Questionnaires

Once the participants finished their test they were given a questionnaire in order for the

researcher to gain more data about the student testing experience on each electronic device. Once

participants finished the questionnaire they were dismissed from the testing room. Student

questionnaire results are represented in Figures 2-11 and Tables 5-9 in the Results section.

Step 22: Conduct Student Interviews

As previously mentioned, the researcher planned to use observational notes to refer to

during the student interviews in order to clarify student experiences. In order to allow the

researcher time to organize the observational notes, she originally allowed 40 minutes time in

between the student testing and the conduction of interviews. Due to a delay in testing the

researcher was only able to have fifteen minutes between the last participant leaving the testing

room and the start of student interviews. Normally during the ninth period of the school day the

researcher would have the eighth grade in her computer class however due to the eighth-grade

students out on their field trip the researcher was able to conduct student interviews at this time

between 2:00pm and 2:40pm. The researcher was able to interview a total of seven students

before the end of the student school day, two students from the iPad test group, two students

from the Atlas 10 test group, and 3 students from the desktop test group. It was important for the

researcher to interview two or more students from each testing group in order to have well-

rounded results about student experiences for each device used for testing. Interview results can

be found in Tables 7-9.

Step 23: Organize Results of Study

Once the data had been collected it was crucial that the researcher organize the data by

device and using student initials in various Microsoft Word and Microsoft Excel data tables. The

anecdotal notes taken by the researcher during the study's testing period were organized in a data

table with the information being separated by device. The data collected from the student

questionnaire was first organized by student and device within a Microsoft Excel sheet using a

separate sheet for each device. Once data was organized the researcher was able to total up the

number of responses for the different questions. Using this data, the researcher was able to

create a database in Microsoft Excel in order to make bar graphs to show the student responses

for each section. In regards to student interview data the researcher organized the student

feedback by student and device in a data table using Microsoft Excel.

Step 24: Draw Conclusions

Once the researcher was able to organize the data of the study into tables and graphs she

was able to determine several conclusions. Although most students had more than seven years of

computer instruction in school the students still preferred a paper-based assessment. Students

also preferred to use external devices such as a stylus or computer mouse when navigating the

testing page especially when using the testing tools. Students also demonstrated that a larger

screen size is also helpful when testing on an electronic device.

Step 25: Identify Limitations

After drawing conclusions based upon the data the researcher was able to identify several

limitations of the study. The first limitation was that one of the initial devices chosen for the

study would not run the necessary software for students to take the computer-based test and

therefore the researcher had to use a different third computer device in the study in order to still

be able to test three different electronic testing devices. Having introduced this device last

minute, the student questionnaire still used the term Microsoft Surface Tablet which may have

led to misinformation given by the student while answering the questionnaire even though

students were told to answer questions pertaining to the test as if they tested on a Microsoft

Surface Tablet as the BAK Atlas 10 was not listed on the student questionnaire. With last

minute changes needing to be made to the study a major limitation was time. The study was

unable to be postponed an hour or reschedule for a different day as the researcher was also

conducting a computer-based assessment pilot for the Diocese of Buffalo.

Results

Student Background

Studies of Pomplun (2007) as well as Choi and Tinkler (2002) revealed that a student's performance and comfort level when testing on a computer is dependent upon their technology background. Because of this, the researcher chose to investigate student's technology backgrounds in the form of a questionnaire. Question 1 from the questionnaire is represented in Figure 2. Figure 2 reveals that twelve students tested in the study had 7 or more years of instruction on the computer in the form of computer classes in school. Only three of the fifteen student participants received less than 6 years of instruction in a computer class. Based on these results, it should have been likely that the majority of students would have been comfortable testing on a computer.
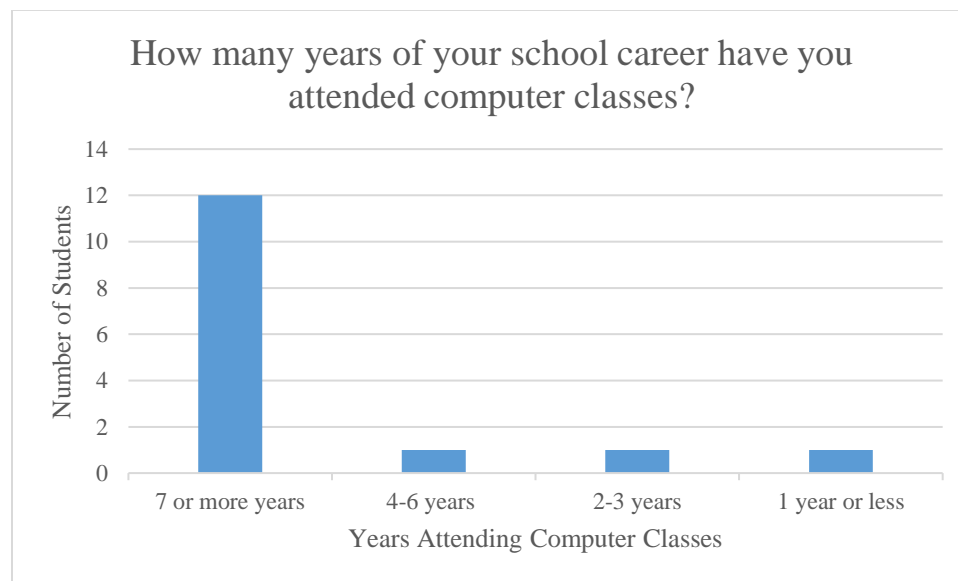

Figure 2. Student Questionnaire Question 1

Question 2 of the student questionnaire investigated the frequency of student computer and mobile device use for school related purposes and is represented in Figure 3.   Ten out of the fifteen (10/15) students who participated in the study acknowledged that they spend 1 hour or less on a computer or mobile device a day for school related purposes. This data suggests that although students have had significant years of technology instruction, they do not use the technology for school related purposes very often.
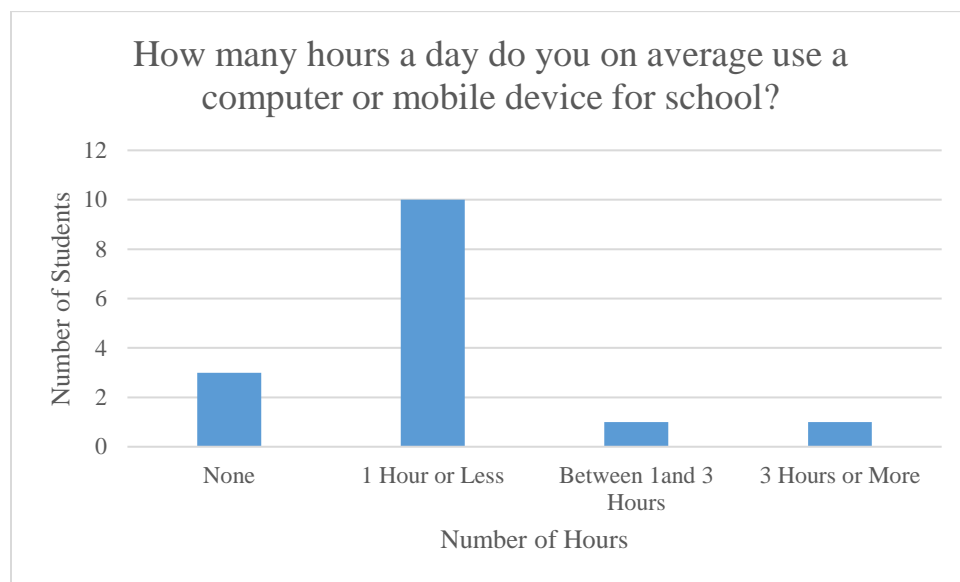

Figure 3. Student Questionnaire Question 2

Question 3 of the student questionnaire investigated the frequency of personal student use of a computer or mobile device. The responses to this question indicated that although most students spend very little time using technology for school purposes they do however spend more time using computers and mobile devices for personal use. Twelve student participants indicated that they spend an hour or more each day using a computer or mobile device for personal or recreational use. This data informs the researcher that although students do not spend very much

time on the computer for school use they are comfortable enough on computers and mobile
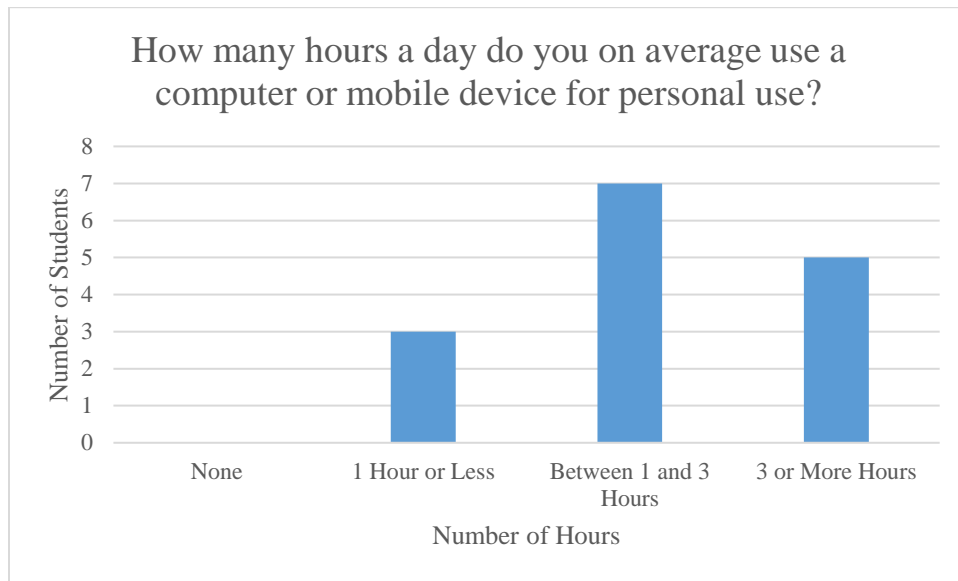
devices to use them in their personal time.

Figure 4. Student Questionnaire Question 3

When looking at a student's technology background the researcher identified the

importance of investigating which devices students use regularly for both personal and

recreational use in addition to school related purposes.   Questions 4 and 5 on the student

questionnaire investigated the devices most commonly used among students; results are shown in

Figure 5 and Figure 6. The most significantly used devices among students for personal or

recreational use were Smartphones, iPads, Laptops, and Desktops. In regards to the devices most

used for school related purposes, students reported to mostly use Desktop Computers, Microsoft

Surface Tablets and iPads which reflected to the researcher that the students should have been

comfortable with electronic devices chosen for the computer-based test in the study.
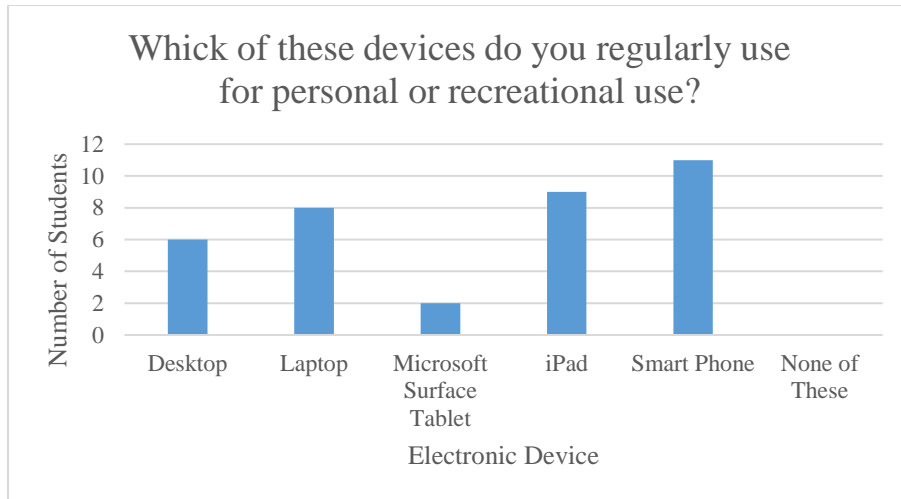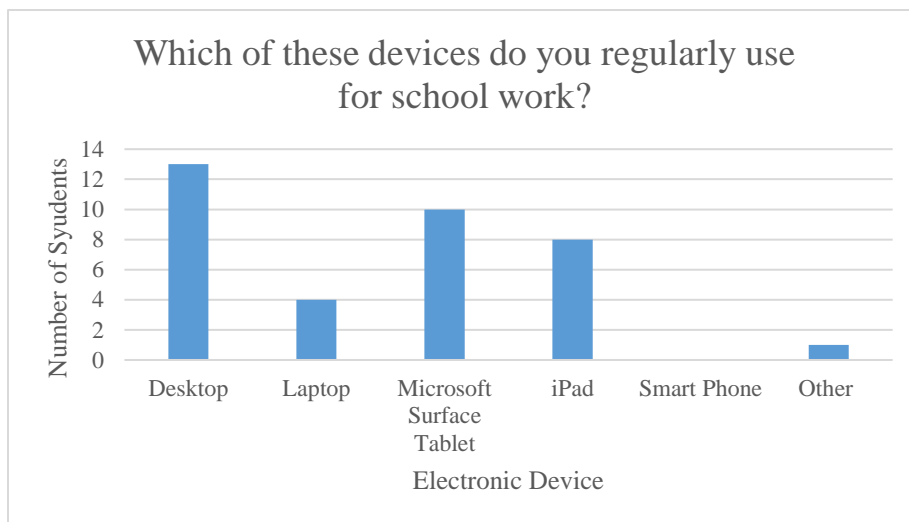
Figure 5. Student Questionnaire Question 4

Figure 6. Student Questionnaire Question 5

Question six on the student questionnaire uncovered which methods students have ever used to take a test or a quiz, results are shown in Figure 7. All 15 participating students recorded that they have taken a test or a quiz on paper but more importantly, the questionnaire revealed that twelve students have tested on a computer and thirteen other responses showed that students have been assessed on other electronic devices, including the Microsoft Surface tablet and the

iPad, which were used in the present study. Again, with this student experience it would have

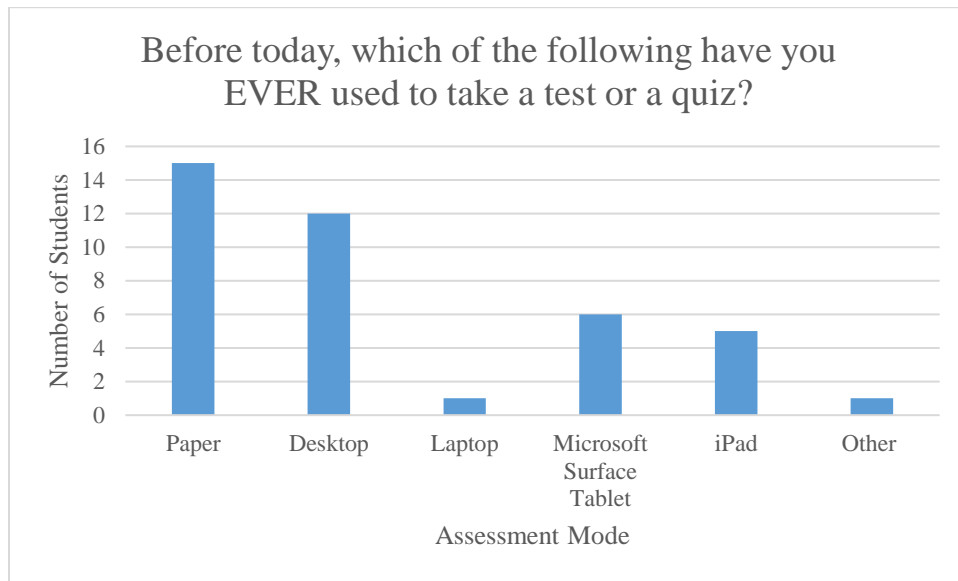been expected that students would have been comfortable being assessed on an electronic device.

Figure 7. Student Questionnaire Question 6

Student Attitudes

Question 7 of the student questionnaire uncovered how students feel about particular

methods of device navigation including touch pads as found on laptops, a computer mouse as an

external device, and fingertip navigation as used on devices with a touchscreen. Results to

question 7 can be found in Figures 8a, 8b, and 8c. Figure 8a shows that the majority of students

dislike using a touchpad for navigating a device however, that four student's feel neutral about

using a touchpad and two students prefer using the touchpad. Figure 8b reflects student's

attitudes towards using a computer mouse. While eight of the student participants prefer to use a

mouse to navigate an electronic device the other seven participants either disliked using the

mouse or felt neutral about the external navigation device. Figure 8c models student responses

for their attitudes regarding the use of their fingertips as a means of device navigation. The

graph below shows that eight of the student participants dislike using their fingertips while seven of the participants have neutral or preferable feelings about using their fingertips to navigate. This data collectively informs the researcher that the mode of navigation that is preferable to students is subjective to the students who are asked due to their being no significant findings based on the question being asked.
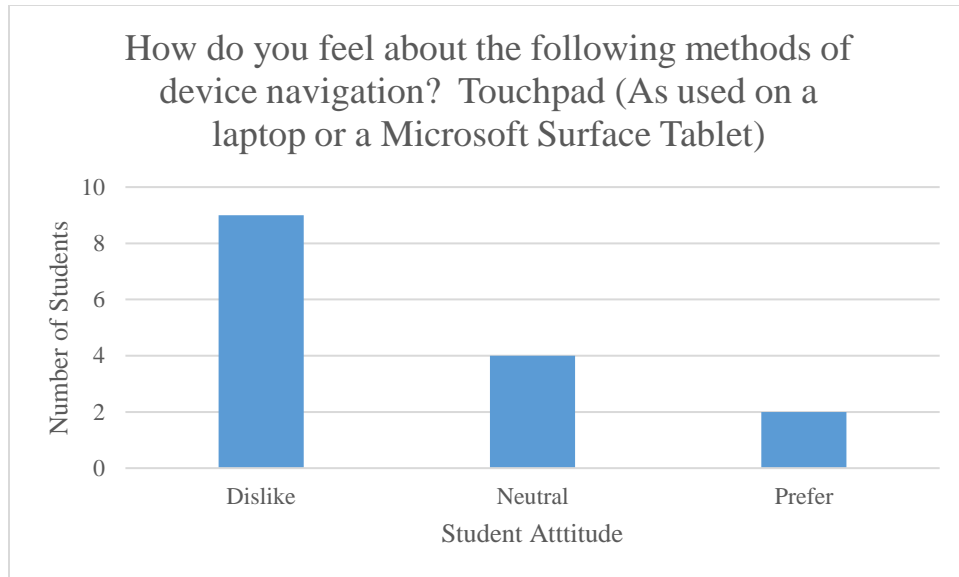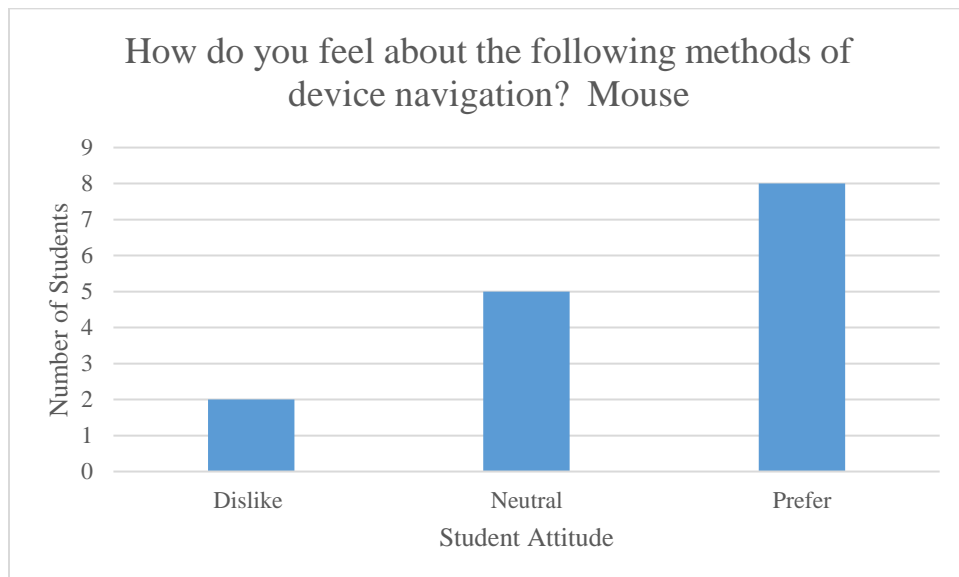

Figure 8a. Student Questionnaire Question 7

Figure 8b. Student Questionnaire Question 7
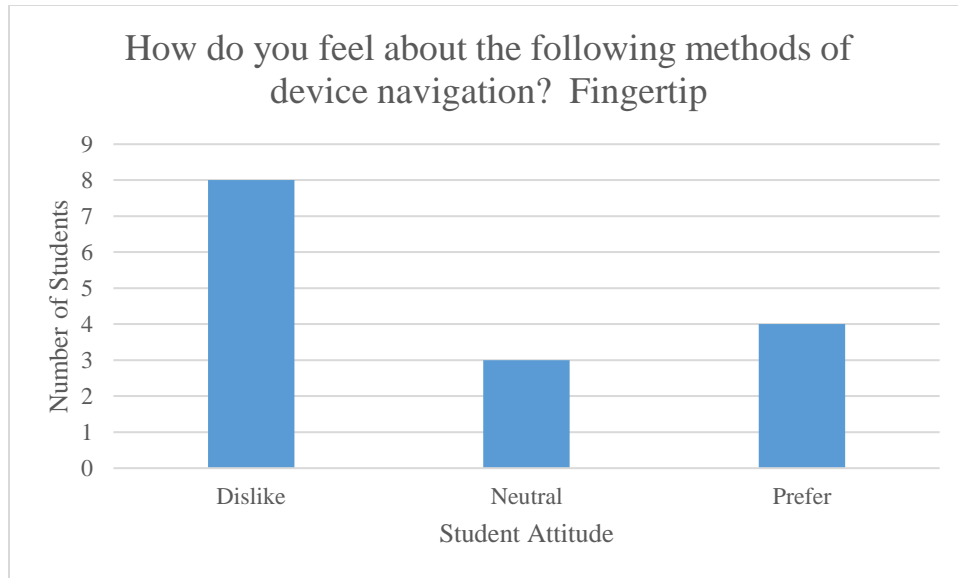
Figure 8c. Student Questionnaire Question 7

In order to investigate the student attitudes of providing written responses digitally as opposed to written on paper the researcher developed question eight of the student questionnaire. Question eight's results are shown in Figure 9 below and shows that students feel mostly neutral about giving their written responses electronically. The results shown in Figure 9 could be a direct result of their many years of computer instruction. The results show that the students feel neutral in regards to how easy or difficult using an electronic device makes writing however, it is important to remember that their neutrality does not suggest that they will write of a higher or lower quality when using an electronic device.
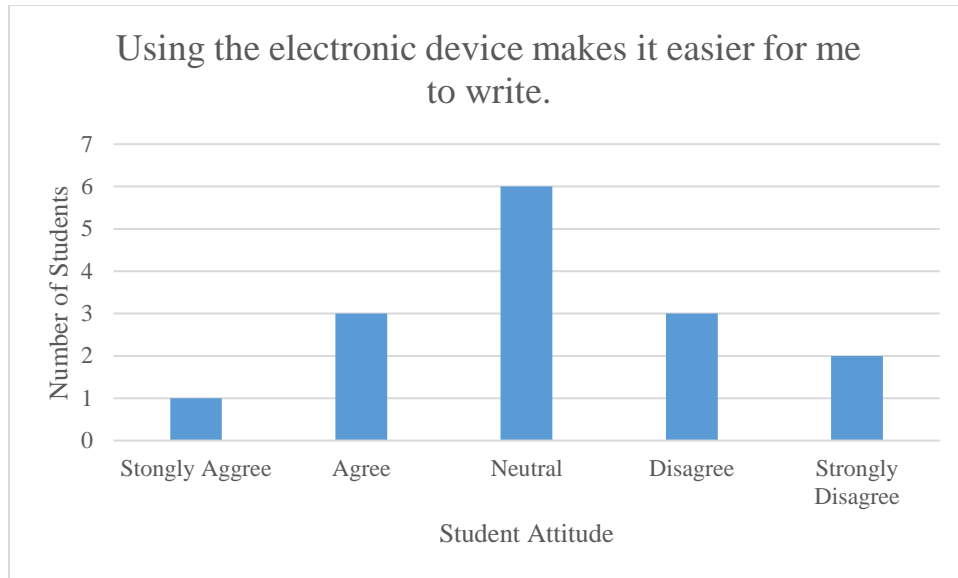
Figure 9. Student Questionnaire Question 8

Figure 10 represents the student responses to question number nine on the student questionnaire. When designing the study the researcher's intent was to have seven students test on each device. Due to complications with logging in, some students had to be dismissed from the testing area. Another complication that creates different results than originally designed is that the researcher intended to have students test on the school's Microsoft Surface Tablets however the researcher found the day of the study that the tablets would not run the Questar software needed to participate in the pilot testing therefore the researcher substituted the BAK USA Atlas 10 devices.
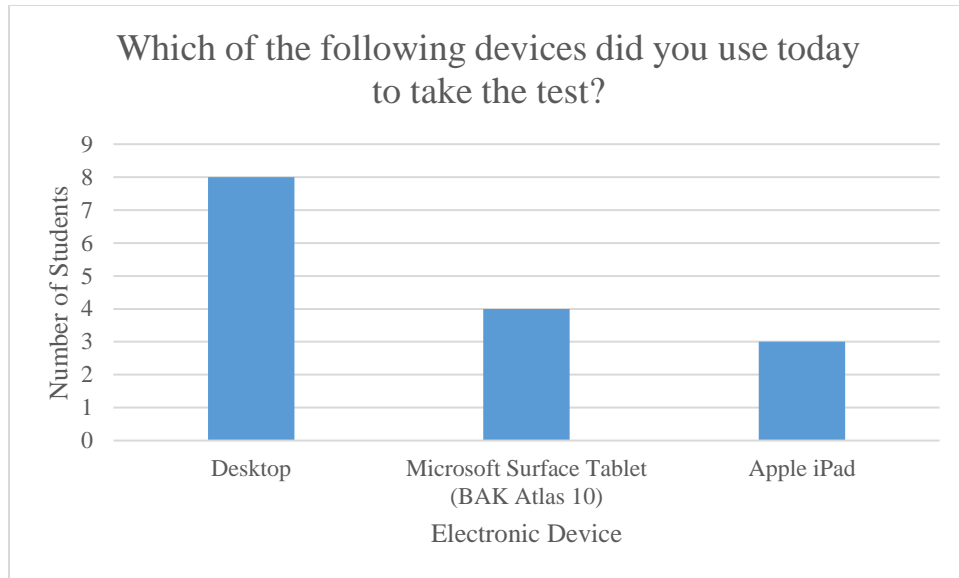
Figure 10. Student Questionnaire Question 9

In an effort for all students to give their opinions about the electronic testing format, the researcher incorporated question 10 into the student questionnaire. Results to question 10 can be found organized in Figure 11 below. All students who were able to test on an electronic device on the day the study took place declared that they would prefer to take the test in the paper-based method. However, there were 6 students who would have also chosen to take the test using an electronic device.
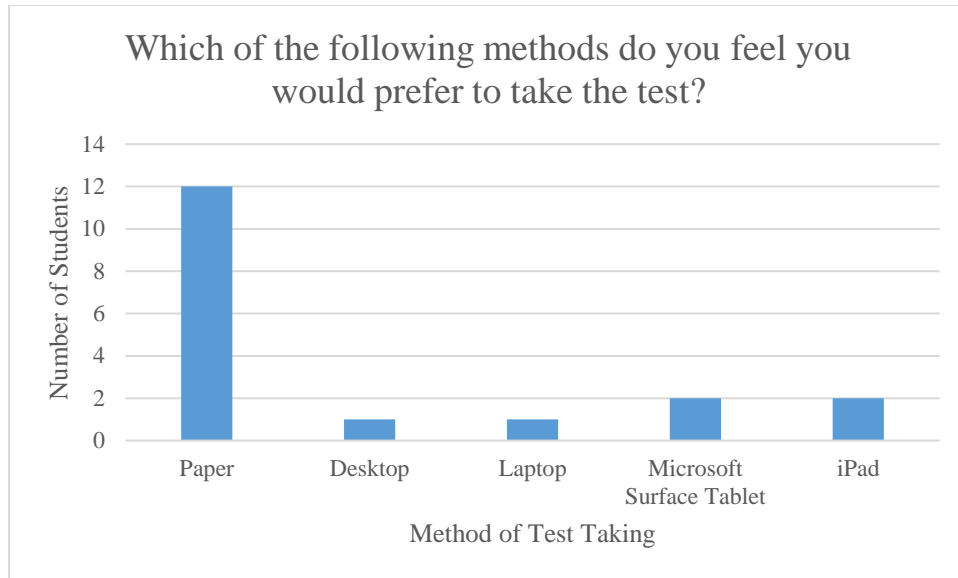
Figure 11. Student Questionnaire Question 10

Table 5 shows the results to the student questionnaire question 11 where students were

asked to describe what they liked and disliked about taking the test on the computer. This

question allowed students to write their personal feelings about the test that may not have been

able to have been answered using strictly multiple choices questionnaire questions. Once the

researcher had collected the surveys she organized Table 5 to reflect all of the answers of the

study participants. The researcher found that students liked that they could type their answers

and enjoyed the tools offered to them through the Nextera testing platform such as the

highlighter and notepad. What students most complained about was that staring at the screen

was giving them a headache. Students also shared that there was too much clicking involved to

navigate the test and it was frustrating to constantly shrink and enlarge the passage or question

box to be able to give an answer.

Table 5.

Describe your likes and dislikes of your experience today testing on an electronic device as opposed to paper.

Device	Likes	Dislikes
Desktop Computer	• Saves paper • Lets you use the tools that you would use on the NY State paper test • Easy to write/type answers • It was easier to answer questions • The questions weren't too bad • Able to highlight my answer, notepad to take notes • I write better on the computer, I didn't have to keep flipping back and forth	• Kicks you off and you lose all of the work you have done • Looking at the screen gives you a headache • You have to shrink the passage to do either writing or reading the passage • You had to enlarge the screen and make it smaller to write and read • Hurt eyes • Too much clicking back and forth • It was harder to find information in the passage • Some classmates could not log in, some had a long bad screen • The stories were too long • Having to scroll and move the passage back and forth to answer my question, going back and forth from passage to passage to get my answer • There was a lot of confusion before the test started, the boxes that I wrote in were very small and I had to keep scrolling to check my work
Atlas 10 (In place of Microsoft Surface Tablet)	• I loved everything about it except what I said in the dislike column • The highlighter, typing it made it faster • You can see the question and the passage at the same time.	• It was a little hard for me to hit buttons while typing • Logs you out a lot, had a hard time logging in • How sometimes it logged you out, how it caused a lot of frustration
Apple iPad	• Easy to type, quick, kind of fun, simple in my case and doesn't use up tons of the paper	• It's harder to write because if you mess up you have to go back and fix it. • I couldn't go back and forth between the question and the passage, took too long to load

To summarize the research findings based on the observational notes over the course of the study, see Table 6. On the day of the study there was a lot of student frustration especially within the first ten minutes of the scheduled testing window due to constant log outs and Guided access issues with the iPads and their keyboards. However students continued to give the testing format their best effort.

Table 6.
Computer-Based Testing Observation Notes

Desktop Computer	BAK USA Atlas 10	IPad Air
- Used provided scrap paper - students were using the provided highlighter (CM) - Some desktops had problems- computer was slow	- Students used the stylus on the BAK device - Student repeatedly sighed in frustration - One student was finished in 10 minutes	Guided access issues on the iPad which did not allow for the external keyboard to function-trouble shooting took place

Other notes:
- Testing was delayed 15 minutes
- Continuous log outs occurred due to testing software
- Students seemed to be kicked out of the system for no reason

Tables 7-9 reflect the responses collected by the researcher during the student interviews. Of the students interviewed many agreed that the constant clicking and scrolling back and forth made the test difficult, hearing the clicking of the keys was distracting, and that staring at a screen for a long period of time was not ideal. What the students found to be positive about the computer-based test was not overly significant. One student reported that testing on the computer was somewhat less stressful because they did not have to focus as much on their handwriting for short response questions. Another student reported that he felt relaxed typing his responses just as he is relaxed typing on his own computer at home. Another positive comment made by a student related to the short response questions saying that by typing, your hands will

not hurt as much at the conclusion of the test. Although students were able to find some

positives in their testing experience on the day of the study, the majority of the students

interviewed did not feel that it was completely fair to test students using an electronic device

rather that the paper-based method in which they are used to.

Table 7.

Desktop Student Interview Data

Student 1	Student 2	Student 3
This student felt that they performed better on the computer because it was easier to find answers rather than flipping through a book The student also felt cramped and wished that there was more room on the screen The student suggests that the passages should be printed on paper and that the answers and writing should be inserted on the computer. The student also said that it would have been better if the passages had line numbers to help guide them through the passages. This student did not think this was a fair way to test because it gives headaches looking at a screen, also it is hard to access the screen fully.	It was noticed during testing that the student was using scrap paper to take notes when asked why they remarked that they prefer paper over the tool provided in the program and the paper also help them plan their essay. When asked if the student felt that they performed better or worse on the electronic version of the test versus the paper test the student felt that they performed worse with the electronic test. The student felt that the electronic format made for distractions with too many buttons and overall the student just prefers paper. When asked what suggestions the student has to make the test better the student said that it is nice to also be able to write on paper but also given more time to plan, respond, and read over. What the student did say they liked about the test was that the passage was next to the questions which meant that there was no flipping. What the student didn't like was all the extra clicking and typing noises in the room and felt it would have been good to wear headphones to cut down on the noise. When asked if the student felt this was a fair way to test the student said that it would be fair because it is the same as the paper test but also no because it is hard to concentrate for some kids and it's hard to focus Overall, the student remarked that their experience was okay but they didn't like reading and writing back and forth. Sometimes clicking made it hard to concentrate. It seemed that the keys and the mouse made the most noise and therefore the student felt they would have preferred and iPad or overall they would prefer paper because it is what they are used to.	The student felt that they would have performed better on a paper version of the test because it was difficult to concentrate with all of the buttons clicking A suggestion that the student had if they were to take the test again would be to have the ability to move the windows on the screen The student like that the test on the desktop computer did not seem to be as stressful as paper because they didn't have to focus on handwriting The student did not like scrolling by the width The student felt somewhat indifferent about the fairness of the test. The test does seem to be more calm digitally however it can be hard to find info and involves a lot of scrolling and adjusting.

Table 8.

Apple iPad Air Student Interview Data

Student 1	Student 2
When asked why the student appeared frustrated during the test he responded that it was difficult to go back and find details The student did not have the paper state test experience to compare this experience to Suggestions to make this test a better experience: having a bigger screen because adjusting the screen can be annoying Student did not have any comments about what they liked Student did not feel that using an iPad would be a fair way to take a test because it is difficult to know how the devices will respond Student remarked that he "hate"ed his experience.	Student remarked that he felt he performed better on the computer based test because he/she was relaxed while typing just as he/she is relaxed at home Some suggestions that the student had for future testing was to look into the load time and how devices freeze, and the need for multiple clicks When asked what the student liked about the test they remarked that it was simple What the student did not like about the test was the small screen size and they would have preferred a desktop with a bigger screen. The student also commented on the small size and the speed was slow When asked if iPads were a fair way to test students this remarked that it was in fact fair however it should be a choice as to what device students can use but that using the iPad prepares them for high schools that mostly use iPads.

Table 9.

BAK USA Atlas 10 Student Interview Data

Student 1	Student 2
It was noticeable that during the test the student struggled with the views and the student responded that there were just a lot of tools for figure out The student said that they feel they performed better on the electronic test than on the paper test because there is more control and your hands won't hurt after writing so much. When asked what would make the students experience better in the future they remarked that there should be no touch pad and just a stylus to use. It would also be helpful if the screen disconnected from the keyboard When asked what the student liked about their test they remarked that it was nice to be able to zoom in and to see the question while reading the passage so you knew what you were looking for. The student did not have anything that he disliked about his test on the computer Although the student liked the device in which they used to test they said that it would be fair to make all students test this way because everything is more accessible and comfortable when the screen has the ability to move. The student also remarked that they liked the stylus and prefers it over the touch pad. The student did also mention that it was annoying not to be able to tab their writing to create an indent when completing constructed response questions.	It was noticeable that the student used the stylus for much of the test and the student remarked that it was easier than using the touchpad When asked if the student felt that they performed better or worse on the electronic test than on the paper state exam they said that they think they did better with the paper test because it was easier to think straight when there were no loud keys and clicks in the room. Suggestions that the student has to make the test better would be that the log in process should be easier and that it would be nice to be able to see the whole passage without scrolling. The student liked being able to use the stylus and well as the highlighter tool. What the student did not like is the noise in the background as well as when they were going back and forth with the touchpad The student felt that this would be a fair way to test if students were given headphones to eliminate the noise.

Student Preference

At the conclusion of the student questionnaire, students were asked to choose a method

that they would prefer to take the test and results are displayed in Figure 11 below. Thirteen of

the fifteen (13/15) students who were able to participate in the study answered that they would

prefer to take a paper version of the test rather than an electronic format. However, of the fifteen

students, some of them chose to include two formats of testing in their answer to the question

which gives a total of six favorable responses towards taking the test using an electronic device.

However, of the four listed electronic devices listed on the questionnaire no electronic device
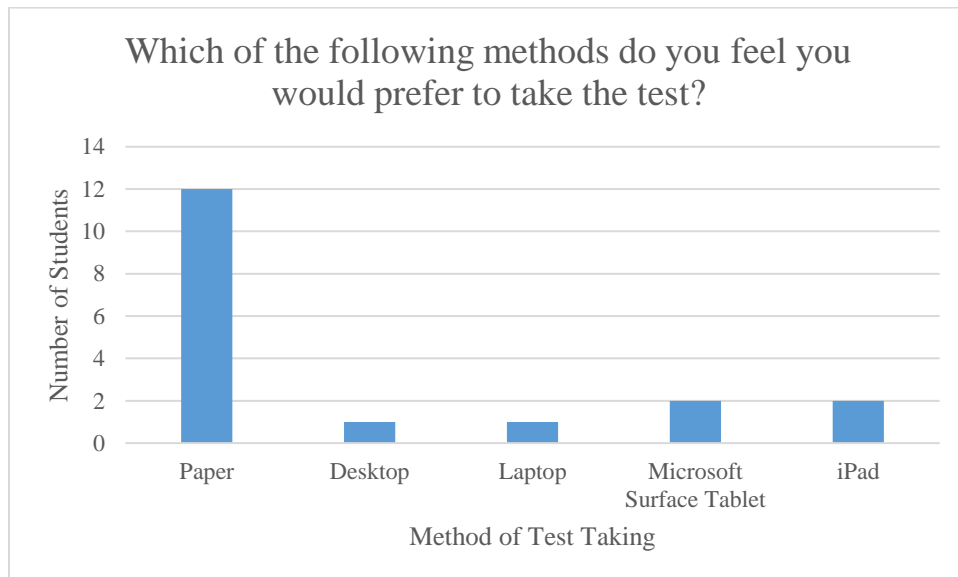
seemed to be overly favorable to students.

Figure 11. Student Questionnaire Question 11

Discussion

Conclusions

Before the design of the study even began, the researcher faced the problem of having to purchase electronic devices for her school as her role of Technology Coordinator. The researcher knew that New York State will require all state assessments to be taken electronically by the year 2020 and therefore felt that it was necessary to collect data that would suggest the most favorable devices when implementing computer-based testing. The researcher then developed the research question, *What computer devices are most favorable to students when administering computer-based assessments?*

The data collected in this study suggests that students would rather take the test on paper rather than an electronic device however in a few years that will no longer be an option for schools. Even though a few students did select devices that may be favorable to use for computer-based testing, there is no clear device that is preferable when looking at the data. However, by conducting the study the researcher was able to come to some very important conclusions that will guide her in purchasing future technology for her school.

The first conclusion was that the school should no longer invest in the purchase of Microsoft Surface Tablets due to their inability to run the Nextera testing software. The researcher was also quickly able to conclude that there are many extra steps to be able to utilize the Apple iPad for testing. Forty minutes prior to students arriving to the testing room the researcher had paired each Apple iPad with a wireless keyboard connected by Bluetooth. Many students who were assigned to test with the Apple iPad struggled with their keyboards becoming disconnected due to the lack of use between setting up for the assessment and the actual testing time. Another problem that the researcher found with the Apple iPad was that the iPad had to be

put into guided access mode before students could log in to the Nextera system. While a few

students were able to navigate their devices to guided access mode on their own, several students

needed to be dismissed from the testing room because their devices could not be set up in a

timely matter. With all the problems associated with testing on the iPad many students in the

room became frustrated even before the test had officially begun. While the iPad still allowed

students to take the test, setting up for the assessment took a lot of extra preparation on the part

of the test administrator.

Two devices that the students seemed to have better experiences with were the desktop

computers and the BAK USA Atlas 10 devices. Of course, students still had some complaints

with each of the devices however when it came to reliability these devices were preferable. One

student complained about the small screen on the Atlas 10. Today, BAK USA no longer

manufactures their Altas 10 device and now manufactures their Atlas 12 in its place. The Atlas

12 has a bigger screen that the students are looking for but also is equipped with several options

as to how students are able to navigate as they can use either their fingertip on a touch screen, the

stylus pen, or the touchpad located on its attached keyboard. While the researcher did find that

desktop computers were preferable in this study it is not realistic to purchase class sets of

desktop computers for the school building due to their large size and lack of mobility.

The researcher has concluded that the best testing device for upcoming computer-based

testing mandates is the BAK USA Atlas 12 device.

Limitations

A major limitation for the researcher while conducting this study was having to stay

faithful to the testing schedule while prepping for the computer-based test on her own while still

teaching her other computer classes on the day of the study. The researcher was unable to set up

the room for testing no more than forty minutes before the testing time due to other teacher

responsibilities as well as the computer lab being in use by other classes in the school building.

The teacher needed to complete the pilot test within a specific time frame because the

researcher's principal had scheduled the Assistant Superintendent of Curriculum, Instruction, and

Assessment for the Diocese of Buffalo to supervise the field test as a way to better understand

the new testing format. If the researcher had a more flexible window to prepare the testing room

and administer the test seven additional students would have been able to participate in the study

rather than exit the room due to technical difficulties.

Another major limitation for the researcher was the unreliability of the Microsoft Surface

Tablet to administer the test using the Nextera software. When reading the guidelines for

devices on Questar's website the researcher concluded that the students would be able to take the

computer-based tests on the Microsoft Surface Tablets. The week that the study was set to take

place the researcher began putting the Nextera testing software on each of the Microsoft Surface

Tablets that were intended for use during the study. When the researcher went to open the

Nextera software on each of the Microsoft Surface tablets she found that the software was unable

to load. Having to make a device change nearly a half hour before the study was about to take

place was a major limitation when it came to the student questionnaire. The student

questionnaire was written to reflect a computer-based testing study that used the Microsoft

Surface Tablet, Apple iPad and desktop computer. When students were answering questions

related to the use of the Microsoft Surface Tablet on the day of the study, students were

instructed to answer as if the questionnaire was asking about their experience with the BAK

USA Atlas 10 device. It was evident as the researcher was organizing the data for the study that

some students were confused by the change. One student even answered the question on the

questionnaire incorrectly regarding the device in which he had tested on the day of the study.

With this in mind the data collected using the questionnaire may have some validity issues

relating to how carefully the students read and answered each question.

As discussed in the Conclusion, many technical issues arose at the beginning of the study.

A major limitation for the researcher was the lack of additional technical support. The researcher

unfortunately needed to administer the test, troubleshoot technology errors, and collect data all at

the same time. If there could have been at least one other technology knowledgeable person in

the room the researcher believes that the study could have gone much smoother and perhaps

seven students would have not had to leave the room due to errors in technology that could not

be fixed in a timely matter.

Suggestions for Future Research

In the year 2020 students in New York State will be expected to take their state

assessments on an electronic device. This study only gave a snapshot of student experiences as

they participated in a pilot study of the new state testing format. With this in mind, the

researcher feels it is crucial for schools to continue to try different modes of testing with their

students. Future research should use larger sample sizes of students and more types of classroom

technology that schools are preparing to use for state assessments. It is also important to include

student attitudes in research designs. If the researcher had not attempted to assess student

attitudes towards using Microsoft Surface Tablets to take an assessment electronically, it never

would have been concluded that it is not a usable device for the state assessments.

This study investigated the perception of different electronic testing modes among

students. While it is important to be sure that students are using electronic devices that they feel

comfortable with in order to achieve to their fullest potential on an assessment, it would also be

beneficial to develop a study looking at student assessment scores parallel to student attitude.

Schools want their students to achieve high test scores and therefore it would be beneficial to

investigate if various electronic devices allow students to achieve higher test scores.

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Appendix A

FREDONIA
STATE UNIVERSITY OF NEW YORK

9 May 2016

Nicole Kashino
c/o Kate Mahoney, Ph.D.
Language, Learning and Leadership
College of Education
The State University of New York at Fredonia

Re: Nicole Kashino— Student Perception of Different Testing Modes in
Computer-Based Testing Administration

Your research project using human subjects has been determined Category 1,
Exempt, under the United States Department of Health and Human Services Code of
Federal Regulations Title 45 Public Welfare, Part 46 Protection of Human Subjects,
46.101, Subpart A (b) (1) and/or (2). This document is your approval and your
study titled "Student Perception of Different Testing Modes in Computer-Based
Testing Administration" may proceed as described. **Your approval is valid from
May 9, 2016 through June 30, 2016.**

Thank you for keeping the high standards relating to research and the protection of
human subjects under the auspices of the State University of New York at Fredonia.

Sincerely,

Judith M. Horowitz, Ph.D.
Associate Provost, Graduate Studies, Sponsored Programs
  and Faculty Development
Human Subjects Administrator

Appendix B
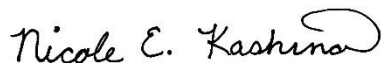**Consent Form for Student Participants**

Dear Student,

On **June 3, 2016** you will be taking the New York State English Examination on a computerized device. In a few years all tests may be given in this way and therefore as a school we want to know what computerized devices are the most comfortable for you to be tested with. As a seventh grade class you are the only students at Saint Benedict School who will be trying out this form of the test and so the feedback you give is very important. **Being a different approach to test taking I will be conducting a small research study in order to determine what devices are most effective and comfortable for test takers. This information will be used for the purpose of making future technology purchases for the school.**

On the testing day the seventh grade class will be **split into three test groups** which will be assigned by Mrs. Lyons and myself. **You will be asked to take the test on one of the following devices: a desktop computer, an iPad, or a Microsoft Surface Tablet. During the test I will be walking around the room and taking notes about any signs of stress that you are showing and whether or not certain devices seem to be harder to use when taking the test. At the conclusion of the test you will be asked to complete a short questionnaire about your own experience on the device.** After surveys are completed I will pull a two or three students from each test group from classes ninth period for a few minutes to discuss the experience further. Once I have collected the results I will report my research findings in the form of a Master's Thesis for SUNY Fredonia however your identity will be kept confidential.**

Please sign below to acknowledge that you will be a participant in this study to help Saint Benedict School decide what types of devices to purchase in the future. **If you choose to not participate in the study signed above you will still be asked to take the test however the observations, survey, and interviews will not apply to you.**

Please contact me with any further questions,

Nicole E. Kashino

Nicole E. Kashino
Miss Kashino
Saint Benedict School Technology Teacher
Phone: (716) 835-2518
Email: nkashino@saintbenedicts.com

Further Information can also be obtained from:

Dr. Kate Mahoney, SUNY Fredonia Associate Professor
Phone: (716) 673-4653; email: kate.mahoney@fredonia.edu

Judith Horowitz, Human Subjects Administrator and Associate Provost for Graduate Studies,
        Sponsored Programs and Faculty Development
Phone: (716) 673-3335; email: judith.horowitz@fredonia.edu

_____Yes I will allow for Miss Kashino to collect an observation, survey, and interview from me on the date of the exam to contribute to the study.

_____ I will allow Miss Kashino to review my test score for research purposes.

_____ No I will not allow for Miss Kashino to collect an observation, survey, and interview from me on the date of the exam to contribute to the study.

_____ I will not allow Miss Kashino to review my test score for research purposes.

Name of Student: _____
        Grade:_____

Student Signature: _____
        Date:_____

Appendix C
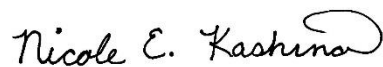**Consent Form for Parents**

Dear Parents and Guardians,

      On **June 3, 2016** students will be taking the New York State English Examination on a computerized device. In a few years all tests may be given in this way and therefore as a school we want to know what computerized devices are the most comfortable for students to be tested with. Students in the seventh grade class are the only students at Saint Benedict School who will be trying out this form of the test and so the feedback that students give is very important. **Being a different approach to test taking, I will be conducting a small study in order to determine what devices are most effective and comfortable for test takers. This information will be used to make future technology purchases for the school in addition to satisfying my Master's Thesis requirement at the State University of New York at Fredonia.**
      On the testing day **the seventh grade class will be split into three test groups which will be assigned by Mrs. Lyons and myself. Students will be asked to take the test on one of the following devices: a desktop computer, an iPad, or a Microsoft Surface Tablet. During the test I will be walking around the room and taking notes about any signs of stress that you are showing and whether or not certain devices seem to be harder to use when taking the test. At the conclusion of the test students will be asked to complete a short questionnaire about their own experience on the device. After surveys are completed I will pull a two or three students from each test group from classes ninth period for a few minutes to discuss the experience further.**
      Please sign below to acknowledge that you will allow your child to be a participant in this research study to help Saint Benedict School decide what types of devices to purchase in the future. **If you choose to not participate in the study signed above your child may still be asked to take the test if you gave previous consent however the observations, survey, and interviews will not be included in the examination of results. The identity of all students participating will be kept confidential in the upcoming study relating to my Master's Thesis.**

Please contact me with any further questions,

Nicole E. Kashino

Nicole E. Kashino
Miss Kashino
Saint Benedict School Technology Teacher
Phone: (716) 835-2518
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Judith Horowitz, Human Subjects Administrator and Associate Provost for Graduate Studies,
      Sponsored Programs and Faculty Development

Phone: (716) 673-3335; email: judith.horowitz@fredonia.edu

_____Yes I will allow for Miss Kashino to collect an observation, survey, and interview from my child on the date of the exam to contribute to the study.
_____ I will allow Miss Kashino to review my child's test score for research purposes.
_____ No I will not allow for Miss Kashino to collect an observation, survey, and interview from me on the date of the exam to contribute to the study.
_____ I will not allow Miss Kashino to review my child's test score for research purposes.

Name of Student: _____
        Grade:_____

Parent Signature: _____
        Date:_____

Appendix D
Student Questionnaire

Now that you have completed a computer-based test please respond to the following questions regarding your experience.

1. How many years of your school career have you attended computer classes?
    a. 7 or more years
    b. 4-6 years
    c. 2-3 years
    d. 1 year or less

2. How many hours a day do you spend on average on a computer of mobile device for school?
    a. None
    b. One hour or less
    c. Between one and three hours
    d. Three hours or more

3. How many hours a day do you on average on a computer or mobile device for pleasure?
    a. None
    b. One hour or less
    c. Between one and three hours
    d. Three hours or more

4. Which of these devices do you use regularly for personal or recreational use? (Circle all that apply)
    a. Desktop
    b. Laptop
    c. Microsoft Surface Tablet
    d. iPad
    e. Smart Phone
    f. None of the choices

5. Which of these devices do you use regularly for school work? (Circle all that apply)
    a. Desktop
    b. Laptop
    c. Microsoft Surface Tablet
    d. iPad
    e. Smart Phone
    f. Other _____
6. Before today, which of the following have you EVER used to take a test or quiz?
    a. Paper
    b. Desktop
    c. Laptop
    d. Microsoft Surface Tablet

e. iPad
f. Other_____

7. How do you feel about the following methods of device navigation?

        Touch pad (as used on a laptop or Microsoft Surface Tablet)
           a. Dislike
           b. Neutral
           c. Prefer

        Mouse
           a. Dislike
           b. Neutral
           c. Prefer

        Fingertip (Touchscreen)
           a. Dislike
           b. Neutral
           c. Prefer

8. Using the electronic device make it easier for me to write
        a. Strongly Agree
        b. Agree
        c. Neutral
        d. Disagree
        e. Strongly disagree

9. Which of the following devices did you use today to take the test?
        a. Desktop Computer
        b. Microsoft Surface Tablet
        c. Apple iPad

10. Describe your likes and dislikes of your experience today testing on an electronic device as opposed to paper.

Likes	Dislikes

11. Which of the following methods do you feel you would prefer to take a test?
   a. Paper
   b. Desktop
   c. Laptop
   d. Microsoft Surface Tablet
   e. IPad

Appendix E
Guided Interview Questions

*All questions may not be applicable to all students

1. I noticed during the test you _____can you explain why?

2. Do you feel you performed better or worse on the test today than you did on the paper version in April? Explain why?

3. If you were expected to take a test like this in the future on the computer, what would be some suggestions that you have to make the experience better for you?

4. What did you like about your test on the computer/ iPad/ Microsoft Surface Tablet today?

5. What didn't you like about your test on the computer/ iPad/ Microsoft Surface Tablet today?

6. Do you feel using (name of device) during testing is fair? Why or why not?