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An Analysis of E-Learning at the High School Level

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I certify that I have read this manuscript and that, in my judgment,

It is adequate in scope and quality for the degree of

Master of Education in Leadership and Administration.

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I would like to thank my mother and my wife, and all the other people who gave me support. If was not for their help I would not have completed this long delayed project.

Dedication

This work is dedicated

to

Abstract

This is an action research capstone project at Sunnyside High school to see if there was any different in performance, in math, between two groups of students based on their method of instruction. The first group taking math in a traditional class room, while the second group earning credit through an online credit recovery class. The sample size of student was too small to draw lasting conclusion from, but student responses to their perception of math was interesting. The use of online instruction is growing in education, and makes this and future studies an important undertaking to see how best to meet the needs of students.

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Chapter I

Introduction to the Problem

More and more high schools are looking to computer based learning technology to solve a variety of educational problems. Given the challenges of serving students who are deficient in credits, finding qualified staff to fill positions or providing upper level courses, and retaining students who are at risk, meeting these needs through the traditional classroom can be difficult.

Some of the difficulties in providing these additional classes are due to the availability of qualified teachers, low enrollment for courses, or available funding. Supplementing or augmenting the traditional classroom with a computer-based tool offers a tempting solution for providing quality instruction at a potentially lower cost. Thus the increased use of computer / online learning by schools is being considered as a way to meet these challenges.

Add to this the rise in the last four years of MOOC, massive open online courses, at the university level (Bartholet, 2013), and you have a good chance that the students of today will spend at least part of their future instruction gaining content and being assessed by an online or computer delivered course. This reality of a new way to deliver instruction to students warrants the need to investigate the merits and success of computer / internet based learning programs.

Both private and public schools, from K-12 through higher education, have looked at supplementing instructional opportunities with computer / internet based learning programs. At the high school level, a leading reason schools are turning to these programs is to reduce or prevent the dropout of at risk students. The dropout rate for students who are classified at risk due to the income level of their family is wider than those students in the middle to upper income levels (Polidano, Hanel, & Buddelmeyer, 2013). Research indicates that students who have a pattern of failing, including not gaining needed credits, especially prior to age 15, are more likely

to drop out of school in that critical transition between middle school and high school. (Wagner, 2001) (Polidano, Hanel, & Buddelmeyer, 2013). This alternate method, computer assisted learning, might be able to provide the support and the programming needed to retain these students in school and increase their academic success resulting in graduation, which is a high priority for schools. How these programs are implemented and whether they result in a higher learning level is the focus and the need of current research (Watson J. F., A National Primer on K-12 Online Learning, 2007) (Journell, 2012).

Due to the accountability rating of schools through No Child Left Behind and the Common Core curriculum, schools are seeking ways to address the dropout rate and to meet Adequate Yearly Progress for all students, especially those labeled at-risk. The flexibility and working at one's own pace offered through computer / online learning appears to be a logical choice for students and schools. However, the research indicates that for various reasons, computer online learning is not the choice of at risk students (Rauh, 2010). Still schools are looking for alternative ways to better serve this population. These students often have a history of failing academically which is also a factor that impacts their motivation to remain in school.

The challenge for educators is how to successfully implement these new educational tools. Converging the benefits of online learning with the perception of this student population towards online learning will determine the success of a school's implementation.

Background, An Overview of the Use of this Technology in Education

More than 250 thousand students are enrolled in cyber-schools nationwide (Tulenko & Wald, 2012). This is out of the 31 million students who are in K-12 education in America today (US Census Bureau, 2010). This makes the number of cyber-school student .8% of the total US

School population. This large enrollment of students along with the various types of available online computer programs gives rise to the notion that instructional delivery is moving in this direction. In his article A National Primer on K-12 Online Learning, John Watson describes the different programs and talks about the pros and cons of their usage in the school (Watson J. F., A National Primer on K-12 Online Learning, 2007). As schools look to increase the graduation rate of their at-risk students, online computer instruction on the surface seems like a logical choice. It allows the offering of courses where there is not a certified teacher in the area; it allows flexibility for at-risk students who are also helping their families financially, by working while still in high school (Wagner, 2001); and it provides the economic advantage to school districts of not needing additional classrooms when budgets are tight.

A brief primer on the breadth of online instruction.

This paper will focus on the use of the computer or the Internet to supplement or replace the traditional face to face instruction of the teacher. The research study will look at the effectiveness of this in Algebra I instruction. Any time the computer or the Internet is used in an educational setting, it is considered computer aided learning or internet based instruction. This paper will make a distinction between when the majority of instruction comes from online sources compared to when online sources are used to supplement traditional instruction. The formatting, the curriculum content, and the model of delivery are some of the variables that further define this type of instruction.

Classifying the models of internet or computer based instruction depends on the terminology used and the various components of each program. There are some common trends in the program that include: online models without any face to face time with a teacher, offsite

locations such as those found in distance learning, access to adults who are available for instruction, tutoring, and/or mentoring, or programs that are strictly an instructional script. There are also hybrid approaches that include traditional instruction supplemented with computer or internet programs. There is also the concept of the paperless classroom where the computer is used to create student digital portfolios. An interesting approach is the flipped classroom where the instruction takes place via the internet, and classroom time is reserved for problem solving and assisting with homework. Finally, there is the MOOC's. These are Massive Open Online Courses, online college classes that are open to thousands of students at a time from anywhere there is internet access. The hope with MOOCs is that by having such a large scale and leveraging social media experiences it can make higher education approachable and more affordable for a great swatch of unreached populations.

It is important to remember that within any new instructional method or idea in general, there are limitations and concerns that should be noted along the way. This new form of instruction will not reinvent education any more than the technology that came before it did, which is very nicely summed up in the Veritasium video "This Will Revolutionize Education" (Muller, 2014). The teacher will always be needed in some capacity. It just changes the skill set that the teacher needs. Tools used by the teacher are not a substitute for the teacher. "The vital human connection between educator and learner will always be the crucial spark in education" (Duncan, 2013).

An advantage of computer / online learning is readily available data that the program can generate. This allows a teacher to immediately assess and adjust the face to face instruction and /or the online instruction to meet an individual student's need. At the same time, some of the data can contain personal information. What happens to this data and who owns this data is an issue that will need to be addressed (Duncan, 2013).

The use of this technology is a growing area in education and looks to be around for the long term.

From the telephone to video to computers to the Internet and tablets, there has always been innovations in how to instruct students in education. It is important to remember that at the center of education, is always the teacher (Muller, 2014). This said, the use of computer aided instruction is not going away. From the pure online classroom, hybrid approach, paperless classroom, or flipped classroom, these models will only become more common in the future. The current resources and research says that when these instructional tools are done right, they might be on par with traditional classrooms in instructional outcome. These same sources also suggest what would be the most efficient way to implement these programs (Watson J. F., A National Primer on K-12 Online Learning, 2007) (Quillen, 2012).

States and school districts are adding online education programs in growing numbers. The growth is seen in both the establishment of virtual charter schools and state led online programs. Some examples of virtual schools that partner with the public school are the Florida Virtual High School in Chicago and Detroit and the Michigan Virtual High School (who have partnered with inner-city school systems), Louisiana Virtual School (which works with local schools who do not have a qualified Algebra teacher), and the Ohio the Electronic Classroom of Tomorrow (ECOT) (being used by public schools to improve test scores) (Watson J. F., A National Primer on K-12 Online Learning, 2007). There are variations in programs but most share characteristics of using highly qualified teachers, learning management software, and digital course content to deliver education to meet a range of student needs (Watson, A National Primer on K-12 Online Learning, 2007). Some virtual schools are totally online utilizing either real time (synchronous) or delayed (asynchronous) feedback to students while others have

teachers and/or paraprofessionals in a computer lab who monitor and work with students as needed.

Through staff development with highly qualified teachers, online learning courses are being developed and taught by teachers who have in the past been instructors in the face to face traditional classroom. Online courses use a software package called a course management system, CMS, or learning management system, LMS. There are also commercial programs being used. APEX is a commercial software program that offers both credit recovery courses as well AP courses. Sunnyside High School uses APEX for credit recovery for at-risk students. Delivery of online education courses range from being highly interactive, to distance learning with less interactivity, to a hybrid model where the two are combined. There can also be the choice of virtual courses where all instruction is online utilizing simulations, electronic textbooks, etc. or virtual classrooms utilizing virtual resources and student teacher interaction as well as including student-student interaction.

As mentioned earlier, an approach to offering online educational opportunities to a large number of students in higher education is through MOOC, massive open online courses. These courses allow large amounts of students through the Internet sign up and congruently and take college level classes, most for little to no fees or charges. Two Ivy League universities, Harvard and MIT, have founded edX which is a non-profit MOOC. Another example is Stanford University where the professors have founded Udacity and Coursera which are for profit MOOCs. Locally, Washington State University is looking to beginning offering courses through a MOOC. There is still a question as to the effectiveness of these types of course with very low completion rates, with only low numbers of students even making it through the first lesson; so

there is a question to how long these types of distance education class will be part of the educational landscape going forward.

Economic and special population factors that are related to online instruction.

There is overwhelming evidence that the economic status of students can play a huge factor in the success or failure of online computer based instruction, from knowledge of the programs existence (Rauh, 2010), to a student's intrinsic motivation and the link that has to social economic background (Bailey, July 2010), and to the simple logistics of access to computers both in the school setting and at home. (Duncan, 2013)

Rice in his article "The Costs of Online Learning" suggests that high cost students, such as English Language Learners, ELL, might not be "well served by the online learning models (Rice, 2012)." Others point out that if there are no ELL strategies included in whatever form of computer based instruction, the results will be the same as the traditional classroom results when there are also no ELL strategies used (Journell, 2012). The major point being made is that the content and structure of the online computer program requires the same quality curriculum development as the traditional classroom to assure student success (McFarlane, January 2011).

With the availability and the potential usage of computer /online instruction, schools need to look carefully at the research to determine the most effective model of implementation. This will involve looking at what the research says about the role of the teacher and how schools can support the teacher. Along with this, schools need to determine how to best serve students based on their learning and educational needs.

Rationale

The point made repeatedly in the literature on computer / online learning is that there is not enough research to determine if this tool provides a greater success in learning than the traditional face to face classroom instructional model, especially at the high school level. One such computer based learning solution, APEX, is used at Sunnyside High School, SHS, to help students graduate on time by making up needed credit. This helps keep that student from dropping out of high school. Keeping in mind that the research indicates that there are pros and cons to the use of computer / online instruction, the use of APEX at SHS begs the question: do students receiving credit acquire an equal or at least comparable education to that of their peers in traditional classroom settings? The purpose of my paper is to explore this question in a limited fashion. I intend to take a quick snapshot of the students' retention of material, both in the traditional classroom as well as with the online use of APEX, to see if there is a difference between the two groups. I also wanted to see, in this snap shot, the student's self-reported views on the method of instruction they received. This is not intended to be a definitive answer to whether the two methods are comparable, but it provided a small sample size action research to launch into a broader conversation as to the proper role, and the use of APEX and computer based learning at Sunnyside High School.

Not all students will gain credit the first time they take a math class, and will have to retake the class. In addition, there are some, with some small desperation, who will be trying to make up credits the final years in high school, in order to graduate. At Sunnyside High School, computer assisted learning has helped with earning the graduation credit for a host of classes including Algebra I. On top of these graduation requirements, student still need to pass a state end of course exam in math to graduate. Is the computer delivered education experience, an

alternative setting, the same quality learning experience as the traditional classroom? This question as well as the lack of research on the high school level is behind the rationale for my study.

The use of Apex at Sunnyside High School.

Sunnyside High School is a 99% Free and Reduced Lunch School (Sunnyside School District, 2012), and the town of Sunnyside itself has a per capita income of 14.5 thousand dollars a year and a 28% poverty rate (US Census Bureau, 2012). Sunnyside HS historically had a low graduation rate of 50% along with math end of course exam passing rates of around 50% and English and writing passing rates on the High School Proficiency Exam, HSPE, in the mid 60% range. These passing rates combined with the demographics of the school and community point to a school in crisis (Sunnyside School District, 2012); (OSPI, 2015). In 2010, Sunnyside HS began to address these issues of the graduation rate and the low end of course exams passing rates. As a result, in 2011, the High School brought its graduation rate up to 61%. Then again in 2012 the graduation rate increased to 80%, and then achieved an 85% graduation rate in 2013. With the intentional intervention that led to the rise in graduation rates, Sunnyside High School is well on its way to addressing its problems; using whatever tools it has at its disposal.

To address the members of the student body who are deficient in the amount of credits needed to graduate, Sunnyside High School turned to a computer learning solution to fill the gap. The program that the High School chose is APEX, provided by APEX Learning, Inc. The use of this online learning, to use Apex's terminologies (Martin, Hiebert, Menon, & Bach, 2009), appears to have played a role in Sunnyside High School's transformation. The increase in the

graduation rate clearly shows that Sunnyside is getting ahead of the problem and now can afford the luxury of examining the tools used to bring about its transformation.

In this examination the question must be asked, is there a difference between the three methods available, at the time of the study? A student can earn credit in Algebra I at Sunnyside High School during middle school, in the traditional high school class, or through APEX. The first two paths to earning credit are grouped together. It is important to ask this question, as well as the research question in this paper derived from this questioning of difference. So to paraphrase a famous allegory in The Republic, shying away from data means to live in the darkened cave, and sometimes light must be brought down to see what shapes cast the images that we see on the wall (Plato).

End of Course Exam in Algebra.

A driving force behind the decision to study math instruction for this action research is that students wanting to graduate from high school in Washington State must pass the state math test. This test at the time of the study was the End of Course Exam in Algebra, and is taken for the first time by students in their freshman year. As my study focuses on algebra instruction at Sunnyside High School, it is worth looking at this test and the math scores at SHS as well as the method of instruction used and Sunnyside's historical scores on statewide testing, 44% pass in 2011 (OSPI, 2015).

When the only assessment that is needed is internal to the classroom, then it is easy to tell if your instruction is meeting that standard. However, when there is an external measure of student success, and one on which a student's graduation depends, then it is important to know if your instruction, in all settings offered, is meeting that need. Increasing the graduation rate is

dependent on knowing if your students are prepared for the high school math EOC exam. This study hopes to begin to address some of that in a limited way.

This study did not, and could not, draw questions from the state's EOC Algebra exam, but the SHS math department has tightly aligned their assessment with the standards from that test. This study used some of these questions to determine, in a limited way, if SHS students are prepared for the EOC. It was not feasible to go back and see if there was any alignment between the student scores on the study's assessment and the state's assessment.

Dearth of Research exists on the K-12 level.

In the Department of Education meta-study of the available research between 1996 and 2008, one of their key findings was a lack of qualified studies about the use of online learning at the kindergarten through high school level. In fact, only after widening the time frame of the search from 2006 to 2008, were quality studies found that compared online learning to face-to-face instruction at the high school level (Means, Toyama, Murphy, Bakia, & Jones, 2010). However, Apex's own research paper suggests three additional meta-studies that provided evidence on this use of online learning and its generally positive impact at this level (Martin, Hiebert, Menon, & Bach, 2009). This points then to the need for more research on this subject at the high school level to see if the findings for the later population remain true.

Considering the data from Sunnyside High School's increase in graduation rate, scores on the State Math test, and the lack of research in the use of computer based learning, this research paper will compare traditional classroom face to face instruction to computer based instruction in the Algebra I course.

Purpose

The purpose of this study is to analyze student outcomes on computer directed instruction compared to the traditional face to face classroom instruction on math achievement in Algebra I.

Research Question

Related Research Questions:

- Is there a difference in student learning in math achievement between computer directed instruction and classroom instruction?
- What is the student's perception of academic achievement between the two settings?

Definitions

Computer / online learning is a term which must be clearly defined in order to understand what the research is saying about its implementation and the success of the students' using it. There are many approaches and various forms that use the computer for the delivery of all or some of the content: Blended Learning, Cyber-School, Distance Education, Electronic Education, E-learning, Hybrid learning, MOOC, Online Instruction, Online Learning, Online Education, Online courses, and Virtual Classroom is just a short list of the names used in the literature. Beyond the list of models, is the number of companies that offer such services which is a long and growing list. ALEKS, APEX, Aventa Learning, Compass Learning, CogBooks, DreamBox, Knewton, Area9, PrepU, edX, Udacity, Coursera, PLATO, Kaplan Virtual Education, and Kahn Academy, to name a few and this is hardly an exhaustive list. (Fletcher, Machine Learning, 2013) (Tulenko & Wald, 2012) (Bartholet, 2013) It may be easier to start with what this paper does not mean by computer directed instruction and then work back to what it is.

Rice in her Review of *The Cost of Online Learning*, is very stern in how the failure to differentiate between the different forms of technology used in education leads to a lack of clarity and focus in the conclusion that a report can draw. (Rice, 2012) The terms listed above, while sounding similar, can have very different meanings, not to mention very different implementations. In addition, the measurement of student achievement in math must be clearly defined because it is on this evaluation that the research design hinges in this study.

Instruction vs. Learning

Instruction: the modality used to teach content that could include direct instruction by the teacher, and the use of computer and other technologies.

Learning: the content that the student has acquired to use and apply. In this study learning is what was measured on the developed assessment. This assessment was a blend of APEX and math department questions covering the topics of 1st order polynomials, linear equations, and solving system of equations.

Sometimes the term education is substituted for instruction. Eisner makes the point to say that education is not learning, that education needs to have a value that guides it, and those experiences that go against this or missed-educational experiences. Further he points out that just because instruction happened does not mean the information was learned (Eisner, 2002). This study is looking for the link between instruction and learning and was not concerned with the education value behind the instruction.

Classroom-based instruction.

Instruction is delivered by a live teacher in the classroom setting.

Another way this is described is “face to face instruction”. By this we mean a student is receiving the vast majority of her education from a live teacher in the traditional classroom setting, also referred to as the brick and mortar classroom.

While occasionally the student may work problems online or use an online tutorial to aid in instruction, this is an exception, rather than the rule. This does not discount the use of technology in the classroom such as calculators, clicker response systems, digital projectors, or Smart Boards.

Computer directed instruction.

Instruction is delivered from an online source or by some software running from a computer.

Although there are different delivery models and programs, the computer is the common factor. There are different models, but the major source of instruction in them is computer based rather than the bulk of the instruction coming from the face to face with the live teacher in the traditional classroom setting.

Computer programs

Commercial or teacher designed content based modules that deliver the subject content through the computer, either through a self-contained package or The Internet.

Instructional models

Separate from the subject content is the instructional setting, the amount of interaction with an adult, the context of the interaction with the adult to the computer program, and the role of the adult(s) to the student.

Synchronous

Online instruction when the teacher is responding to the student in a real time situation.

Asynchronous

Online instruction when he student engages with the content and submits his work independently, and the instructor responds at a later date.

Virtual schools.

Online instruction that is asynchronous. (Battaglino, Haldeman, & Laurans, 2012)

Blended-learning schools.

Combination of online learning that can be synchronous or asynchronous, and traditional face to face instruction (Battaglino, Haldeman, & Laurans, 2012).

Also can be referred to as a hybrid environment, though the professional literature and best practices distinguish between the two terms based upon the proportion of computer-based and face to face teacher directed instruction (Gustke, 2010). This is the model that APEX uses.

MOOC (Massive Open Online Courses)

Online learning that is asynchronous. Primarily designed at the post high school level, as free online classes offered to larger numbers of students concurrently. MOOC often mimics social-networking sights and integrating online videos, online comments, and question and answer sections. (Waldrop, 2013).

Achievement

Achievement can refer to the long range goal of the students' retention of the material, or simply the short term goal of passing some assessment. For this study, we are focusing upon measures of short term learning within the classroom, and the results of the state achievement test, both in math.

At Risk Students

These students are defined by the as one who is likely to fail at school (U.S. Department of Education, 2009). School failure is typically seen as dropping out of school before high school graduation (Archambault & Diamond, 2010).

A student who will drop out of school prior to graduation is an at risk student. The academic characteristics of an at risk student may include academic failure resulting in falling behind achievement level of peers and in lack of promotion to the next grade level, not reading at grade level, and failing two or more courses. Other academic characteristics may include students with special needs or ELL students. Non-academic characteristics may include low socio-economic status, from a single parent household, an older sibling dropped out of school, changed schools two or more times, health issues such as pregnancy or being a parent, and the need to work to help support family (Watson & Gemin, Using Online Learning for At-Risk Students and Credit Recovery, 2008). Other groups such as the U.S. Department of Education and Southwest Educational Laboratories include the above as well including the educational level of parents, disabilities, teacher perceptions of the student, student behavioral factors, psychosocial factors, and the characteristics of the student's school (Archambault & Diamond, 2010).

Students at risk of dropping out of school have been targeted by schools for online learning for both credit recovery and increased graduation rates. The research reviewed for this paper indicate that there are strategies that are shown to be successful with at risk students.

Research Design

This is a mixed quantitative action research project, incorporating survey results with outcomes on a common assessment. The main point of the research is to focus on the difference between two groups of students who pursued credit in Algebra I; students in the traditional classroom vs. students who engaged in online learning by use of APEX.

A summative assessment of 16 questions was given to both groups of students, covering function, solving 1st order polynomials, linear equations, and systems of equations. These questions covering the topics listed above were taken from two sources; half from APEX quizzes and half from the common assessment developed by the Sunnyside math department. In addition to this, a five question survey assessed the student's feeling for math and the method of their instruction in Algebra. Along with this, each participant was given a self-reporting demographic questionnaire.

To analyze the data, a t-test was used to see if there was any meaningful statistical difference between the two groups' scores on the assessment test. Then an ANOVA statistical test was used to see if there was a link between a student's response to perception questions and their scores, as well as if there was any link between a particular piece of demographic data and the student's score.

Summary

It is clear that computers have been with education for many decades now, and the Internet close to two decades. The use of these two technologies is nothing new, but with the increase of computer power and the ability to deliver more and more content over the Internet, its use in education will only grow. On top of this, instruction solely through the use of computer and online, bi-passing the traditional brick and mortar classroom and sometimes the teacher, is also on the rise. Whether it will become the dominant form of instruction in the future is questionable.

This alone would make this a worthy topic to study, but add on the lack of quality research, the potential for great good and harm in its use, and on a local level the use of this technology to aid in student achievement at Sunnyside High School, I have chosen this as my research topic. While my comparison of two student populations' performances on a common assessment as well as their perception to instruction is very limited in scope, I hope that this study can spur greater discussion in the future.

Chapter II

Review of the Literature

Online education is a growing part of today's instructional options. Some of its uses include credit recovery, filling the gap of highly trained teachers, and providing college classes for large groups of students. The use of computers and online learning is a new addition to distance learning. We live in a highly connected world and it is only in the past two decades that much of what is called e-learning has become mainstream. Trends are emerging as to what constitutes effective use of distance learning and particularly computer and online learning.

In John Watson's article, Primer on K-12 Online Learning, he lists several misconceptions about online learning. Chief among these is that online programs cost less; as well as online classes are teacher-less and do not require a highly skilled and trained teacher; are only for the highly motivated student or conversely the at risk student (Watson J. F., A National Primer on K-12 Online Learning, 2007). The research reviewed in this chapter will address these misconceptions. In addition, it will address what the field has to say about implementing these programs and training teachers for successful programs. The last topics addressed will be the impact on at risk students.

To put the research in perspective, it is important to have a historical overview to online education and how online education arrived at this point. Alan Clardy, in his article Distant, Online Education, Effects, Principles, and Practices, states that online education began one hundred years ago with correspondence courses (Clardy, June 2009). It has evolved from a paper based model to what he calls the 5th generation Intelligent Flexible Model which allows a 24-7 access to a campus portal (Clardy, June 2009). Donovan McFarland echoes this history when he

discusses the movement from Distance Learning to the birth of Internet Technology which has led to virtual schools with no physical building (McFarlane, January 2011). This transformation dates back to the 1980's and 90's as the field of technology expanded. With the advent of the computer and internet access, the definition of school has changed. How information can be delivered has made computer / online learning available to anyone, anywhere who has access to a computer (McFarlane, January 2011).

As exciting and as diverse are the possibilities of using this technology in education, there is also the need to further explore the effectiveness of virtual schools, the effectiveness of computer-based delivery of instruction, and the technology they utilize. This exploration is especially needed to determine how this technology can best benefit the at-risk population in schools. It is for this population that many schools are looking to computer / online learning for credit recovery and dropout prevention (Archambault & Diamond, 2010).

Implementation Issues and Challenges to Online Education

There is no doubt that the use of online resource is growing in education. Even before the program is selected or a decision is made on what approaches the curriculum and pedagogy should take, there are administrative details as well as perception and perpetrating challenges that must be overcome. Resource management and allocation is a big reason schools choose to implement online learning. The perception that this is cost efficient is what makes online learning attractive to schools (Journell, 2012), though these perceived savings tend not to be real (Watson J. F., A National Primer on K-12 Online Learning, 2007). Another factor that needs to be addressed is the physical location in which the students participate in the computer based learning programs. With all the stakeholders involved in the implementation of online education,

care must be taken to address efficacy for successful implementation. Last, proper training needs to be in place so that the programs can run successfully. Studies have shown that some teachers are concerned that their role in instruction will be diminished or replaced with online education courses (Quillen, 2012). Both teachers and administrators will need to understand the dynamics of online education in order for it to be successfully implemented. Finally, there is also a misunderstanding of the benefits for online education by parents (Rauh, 2010).

Budget, and facilities allocation present a challenge to an effective online learning program.

Funding allocation is always an issue in education. While the perception is that online education is cost saving, whether that is the case will be determined by how schools implement online programs. Those who believe this is the case, advocate greater implementation, especially in Charter schools (Lips, 2010). Others feel that the cost saving in some aspects of online education is often balanced out by additional costs elsewhere (Journell, 2012). Again and again, the research shows that the use of a blended approach that combines online learning with face to face interaction with adults has the greatest impact on learning, so having a physical location for a least part of the instruction is needed. This is an allocation issue for both adequate facilities and for the needed technology in those facilities.

Cost saving is not a rationale for implementing online education.

In his primer of online education Watson states that he does not believe the decision to implement online education should be solely based on economics; that an instructional decision based on cost savings is not sound policy. (Watson J. F., A National Primer on K-12 Online Learning, 2007) A perceived cost savings factor in the decision to move to online education or to increase its use is the reduced need of physical buildings. The schools that are exclusively

online with no physical building such as the Ohio eCommunity Schools virtual schools report that funding is equal to that provided in the face to face setting (Watson J. F., A National Primer on K-12 Online Learning, 2007). Another perceived cost saving factor that is considered is in the reduced cost in bussing and overcrowding of schools (McFarlane, January 2011) (Journell, 2012). These cost savings are balanced out with the increased cost of technology and additional technology support. Also, while it may be assumed that virtual schools or online learning can result in a decrease of classroom teachers, an effective program will need to switch to more technology centrist teachers to manage these courses (Quillen, 2012).

Thus a careful look at the actual costs is needed prior to the implementation of an online learning program. The selection of an online learning program needs to balance the perceived cost savings with research on what components create the most effective instructional program.

Requirement for successful program requires a physical location.

As more schools, both public and private, have begun using computer / online learning, the movement has been towards also requiring face to face interaction with adults. Schools utilizing online learning have found that combining the online with face to face interactions provides flexibility to work with students one to one, to support students who need a non-traditional setting, and to facilitate pacing of those that want to work at their own pace. The Cincinnati Public Schools Virtual High School is one example of a school that took the tool of digital online learning and put it into the brick and mortar setting. Students complete their course work online while adults are available to work with them as needed. The Odyssey Charter School is another example where students are required to attend a face to face setting four hours per week allowing adults to work one to one with students to mentor and instruct. A final

example is the Commonwealth Connections Academy's drop in center where students work with a highly qualified teacher who often also teaches their online courses. Using the test scores, online activities, and portfolio assignments, deficiencies and gaps are identified and addressed by the teacher. The Principal of the elementary school of the Commonwealth Connections Academy is quoted to have said, "The face-to-face time at the drop-in-center has helped us identify barriers to student's learning and provide solutions through a model 21st century virtual delivery system." (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008).

The blended instruction where students are required to attend a physical location allows teachers to provide direct support to students. This model utilizes the best of teaching that includes monitoring of student success supported by teacher intervention to provide one to one mentoring, meaningful group activities, and modified instruction as needed. In the above examples as well as others, both teachers and administrators are positive about components of the blended model. Finally, blended models of online learning and face to face interaction in a physical location gained time for teachers to provide the individualized support, which is of high value to teachers (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008).

Implementation is affected by the perception of online education by stakeholders and their efficacy.

Wayne Journell discusses an online US History class that he was studying in which both the students and the teachers saw the course as little more than a means to an end; the end being passing the state test and getting the diploma rather than also acquiring knowledge and engaging in the content. He speaks to the need by the district to address these misconceptions about the

program and address the realities of online education (Journell, 2012). He is not alone in pointing out that many stakeholders do not understand the proper role of online education (Watson J. F., A National Primer on K-12 Online Learning, 2007).

If the efficacy of those involved is not in alignment with the quality standards of education and is not more than a form of simple instruction, then online education is likely to fail in the same way as any bad instruction would. It is a false idea that there is a way to have online classrooms be the replacement of a host of good teaching practices. The efficacy of instruction must be at the highest quality in any instructional setting (Watson J. F., A National Primer on K-12 Online Learning, 2007) (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008) (Journell, 2012) (McFarlane, January 2011).

Teachers are threatened by online education, yet they still see its value.

Two issues are raised in the research about the attitude and concerns of teachers in regard to the implementation of online learning programs. One of those is the concern of job loss. Online learning allows for courses to be offered for low enrollment classes and in locations where a qualified teacher is not available. This was discussed in an article on foreign language courses suggesting that the loss of jobs was a significant concern. However, the article went on to explain, that the opposition is more centered in the concern of teachers in regard to the quality of instruction (Quillen, 2012). This concern is echoed in a lengthy discussion of the importance of the organizational structure, and how the understanding of the role of technology, as a medium of delivery, impacts this attitude (McFarlane, January 2011).

Online learning requires that teachers think differently about their role as an educator. They are no longer just the disseminator of information within the four walls of a

school. This can be a paradigm shift as they move to the role of mentor and guide. A key component is the need for teacher staff development. The area of staff development needs to be both in how the technology works as well as how to effectively use it in the classroom setting (Archambault & Diamond, 2010) (Cavalluzo, Lowther, Mokher, & Fan, 2012) (Watson J. F., A National Primer on K-12 Online Learning, 2007). In addition, the development of a digital curriculum requires an understanding of effective delivery in this medium. The role of the teacher is critical to the success of the online program (Angiello, 2010).

Administration support to handle behind the scene work is essential.

Setting up a process where online or computer-based courses can work in a pre-existing structure is essentially an administrative task, but crucial to the success of any such program. Addressing this concern while at the same time utilizing the benefit of providing courses to students when a qualified teacher is not available is a challenge for administrators and school districts. The selection of quality online courses and the monitoring of student learning is a critical responsibility.

While the jobs of teacher and administrator are not lost when shifting to online or blended instruction delivery, it does require both teacher and administrator to rethink how it is done. (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008)

Administrators must consider a variety of areas as they work to assure the success of online learning in their setting. The inclusion of online learning in schools begins with the reform of policies that include creating venues for online learning, incorporating online learning into the traditional school system, and reforming funding systems (Lips, 2010). The organization of

virtual schools and brick and mortar schools include many of the same areas, but the degree of importance and impact on the learning environment differ in each setting. These include number of faculty, course offerings, schedules, class size, and cost (McFarlane, January 2011).

Alan Clardy in "Distance, On-line Education: Principles and Practices" suggests that areas administrators must consider should include:

- budget and policies that are centered on the students' success;
- adequate infrastructure for technology and physical locations;
- continued oversight of programs and student progress;
- development of curriculum and instruction at the highest standards;
- involvement of highly qualified teachers in the development of the curriculum;
- support of faculty in the areas of staff development and risk taking;
- fully supporting students with plans and policies in place prior to the start of the program (Clardy, June 2009).

When virtual schools and online learning are seen as being in competition with the traditional brick and mortar schools, then the attitude and the effective use of these new tools is diminished. Thus administrators must consider both the pedagogy and the organizational structure to create successful programs (McFarlane, January 2011).

Completion of the course and satisfaction with the experience are impacted by the student's view of online education and motivation.

In a study with 6th graders in a math classroom, the students highly rated the experience of online learning because of communication and working at their own pace (Clayton Edwards, 2013). The flexibility of working at their own pace was also given as a reason for students'

satisfaction with online learning in the research of Veena Deshmukh. Along with the communication and pacing, students liked the positive feedback received from the instructor in the online course. (Deshmukh, Forawi, & Jaiswal, 2012)

A quasi research study done with 8th and 9th grade Algebra I students in rural Louisiana school districts provides a look at the attitude of students who took the course online compared with students in the traditional face to face classroom setting. A survey was given to both groups of students to assess their comfort level with technology, their experience in class, their interaction with the teacher, and their interaction with each other. Assessment of their learning showed that the group who took the course online outscored, in math ability, those in the traditional face to face setting. What is interesting is that the students who took the course online had a lower perception of how well they learned the material even though they enjoyed the learning through technology, and scored the same on the assessment. It was suggested in the article that the delayed feedback and dispersed authority may have impacted their response to this survey item. It was also the first time that the group had done an online course, so the newness may have contributed to less satisfaction with the course. Two other survey items showed that the online students had a higher confidence in their technology skills at the end of the course and that they interacted more with their peers, to talk about the math in the course, then the face to face students (Laura M. O'Dwyer, 2007). What makes this study of interest, is that along with the highly qualified online teacher, there was also a teacher who was not certified in Algebra I in the computer lab with the students who addressed issues of technology, responded to questions related to the subject area, proctored exams, and created a positive learning environment. The overriding implication is that communication between the adults

involved in the instruction, whether the online teacher or the onsite teacher, impact the satisfaction level of the student (Deshmukh, Forawi, & Jaiswal, 2012).

A final area to consider is related to motivation and working independently when taking an online course. The dropout rate of some populations, especially students from schools with high poverty rates, is higher when there is no face to face interaction with an adult. In working with at-risk students, motivation is maintained when students are validated and have meaningful relationships. Programs that recognize the specific needs of students have a higher success rate in retaining students (Archambault & Diamond, 2010). Further, programs that use blended learning including both online and face to face portions have greater student satisfaction ratings (Nikolaos Vernadakis, 2012).

Teacher training and preparation of online learning is needed to assure teacher support and engagement

The importance of staff development in the transition to online instruction is mentioned in multiple articles reviewed for this study. The Kentucky Virtual School was highlighted as a program that requires ongoing staff development (Cavalluzo, Lowther, Mokher, & Fan, 2012) (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008). When teachers engaged in the staff development, the research indicated greater success of the students (Cavalluzo, Lowther, Mokher, & Fan, 2012). The incorporation of technology into education, whether in virtual schools or the traditional brick and mortar setting requires that the organizational structure include teachers and instructors in technology activities, while fostering a high degree of collaboration among teachers in the use of e-learning technology, and fully

support teachers in this collaboration and use of e-learning technologies (McFarlane, January 2011).

To ensure quality education the need for professional development is no different for online instruction than it is for traditional face to face instruction.

New skills are needed for teachers to be successful in the use of and instruction using online learning. Two areas are the focus of staff development. First is in the use of the technology itself. The second is in effective teaching strategies to use when developing online learning lessons. The recognition that the teacher is at the center of any instruction whether it is online or in the traditional face to face setting is echoed throughout the literature. At the same time, the skills needed to be effective in online instruction are different and thus need to be addressed through staff development (Watson J. F., A National Primer on K-12 Online Learning, 2007). A proactive approach as used by the Kentucky Virtual Schools for the teaching of Algebra I begins staff development with teachers the summer before they begin teaching using a blended program and continues throughout the year (Cavalluzo, Lowther, Mokher, & Fan, 2012). The success of online education is dependent on a strong policy that includes staff development (Archambault & Diamond, 2010).

Curriculum development as important as in a traditional classroom.

What separates the traditional face to face instruction from online instruction is the technology. Thus it is important to recognize this difference and to address it in both organizational structure and in the pedagogical approaches through curriculum development, assessment, and staff development as discussed above. The development of curriculum in the context of online learning must be seen as the creation of an environment of learning that uses

technology as medium that supports rather than drives the instruction (McFarlane, January 2011).

The research indicates that the blended online and face to face instruction has the highest results in student performance. Factors that influences the effectiveness of blended instruction needs to be considered in curriculum development and potential software selection. In the article "E-Learning Works", there are four factors listed. They are content (level of richness as exemplified by a multimedia presentation), immersion (level of reality), interactivity (between learners, between learners and instructors, and between learners and simulated characters), and communication (different communication channels as well as allowing learners to communicate synchronously in real time) (Bell & Federman, 2013).

Curriculum and Pedagogy – What works and doesn't work in Online Curriculum Design

Overall the research suggests that this new mode of education is not a great paradigm shift in outcome, but if it is to work or at least be on par with the traditional classroom, then a blended approach is recommended. A blended approach means that the learner spends some of the time with adult interaction and some with the computer. This adult interaction can take many forms, but it is critical to the success of the student.

What does work in online education.

McFarlane, in his comprehensive comparison of online education (or teaching) to traditional teaching, poses similar factors to those of Bell & Federman (2013) that have a positive impact upon student learning, in that effective learning takes place when there is active engagement, group participation, feedback (interactivity) and interaction on a frequent basis (communication), and connection to contexts outside of the classroom (immersion). How well

the traditional classroom as well as the virtual one meets these elements determines the effectiveness of the instruction no matter the mode of delivery (McFarlane, January 2011). While he was referring to higher education, I believe these three goals in curriculum design also applies to the high school level. It is by these benchmarks that the level of quality of a program can be assessed. In fact, McFarlane goes on to say that there should not be a great difference in pedagogical approach between virtual and brick and mortar schools, due to having similar goals and organization structures. (McFarlane, January 2011)

Overall, the research indicates that the best Pedagogical approach is a blended design that mixes elements of both the traditional classroom as well as the online one. In this there are several pitfalls to be avoided such as the student having no interaction with adults while pursuing his education, the lack of an effective monitoring of student progress, and poor curriculum design. These factors could easily derail a traditional classroom as well. That said there are a series of strategies that are effective to a successful program. These are in addition to the reverse of what was just listed. Strategies such as one on one teacher-student interaction (Archambault & Diamond, 2010), teachers well trained in pedagogy and in the use of technology and how the online curriculum works (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008).

Blended instruction has various characteristics that makes for a successful model.

Schools are moving to the blended model of delivery. The question of whether there is increased learning using a blended model of instruction varies from study to study depending on the focus of the study. Some studies that compare online instruction to face to face instruction, conclude the overall outcome of student learning and retention is not significantly different (Lim,

Morris, & Kupritz, 2006). Others suggest that the pedagogy of the blended model leads to a higher learning outcome (Pregot, The Case for Blended Instruction: Is It a Proven Better Way to Teach, 2013).

One factor that seems to influence this decision is student satisfaction (Lim, Morris, & Kupritz, 2006) (Deshmukh, Forawi, & Jaiswal, 2012). A second factor is student retention (Pregot, The Case for Blended Instruction: Is It a Proven Better Way to Teach, 2013). A third factor is related to immediate feedback and individualizing the curriculum to address a student's needs (Pregot, The Case for Blended Instruction: Is It a Proven Better Way to Teach, 2013) (Archambault & Diamond, 2010).

Connection to an adult impacts student satisfaction. Also, the pedagogy of the blended delivery model can provide access to visual imagery that a lecture approach may not offer, thus creating higher student satisfaction. In a well-planned blended teaching modality, student success can be raised (Pregot, The Case for Blended Instruction: Is It a Proven Better Way to Teach, 2013) (McFarlane, January 2011) (Zhang, 2004) (Martine Pellerin, 2012).

This connection in the face to face component of the blended model varies from interaction with the actual online instructor to having an adult present in the computer lab where students complete the online course. In both of these situations, the student receives individual support and easy access to an adult. The teacher in each of these settings, whether a highly qualified teacher or a para-professional, monitors student's progress and curriculum is adapted to address the student's learning needs (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008), (Watson & Gemin, Using Online Learning for At-Risk Students and Credit Recovery, 2008) (Archambault & Diamond, 2010). Recognizing early on the

barriers to a student's learning leads to greater success (Archambault & Diamond, 2010) (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008).

Student retention is a key component to success. Schools have found that by requiring students to attend a face to face instructional setting along with the online learning have greater retention rates (citation). What seems to be consistent in determining what impacts this retention is the interaction between student and instructor, the building of a relationship (Bailey, July 2010). In a study with college students in South Texas that looked at the success of students in relation to their log-in times and length, those who had higher logins were more successful (Kupczynski, Gibson, Ice, Richardson, & Challo, 2011). When considering the population of students at Sunnyside High School, and those in studies related to 9^{th}-12^{th} graders, the benefit of the blended model which combined face to face with online instruction, the face to face component emerges as an important factor in creating that adult interaction which leads to a relationship that increases retention rates.

On-Line Learning for at Risk Students

In his article, "Today's student and virtual schooling: The reality, the challenges, the promise...," Barbour (2009) stated:

> *The majority of the literature may portray K–12 online learners as being primarily highly motivated, self-directed, self-disciplined, independent learners who read and write well, and who have a strong interest in or ability with technology. However, this is clearly not an accurate description of the entire or possibly even the majority of students attending virtual schools and, particularly, cyber schools. (p. 18)*

The students he is referring to are classified as at-risk. Both public and private schools are using computer / online learning specifically targeted towards serving students at risk for dropping out of school. The research highlighting the strategies that work with this population reveal major results and an increase in graduation through credit recovery, which is achieved most successfully when direct interaction and relationships are built through the presence of an adult.

Who are at Risk Students Whom Benefit from Computer Online Learning

At-risk students benefit from computer / online learning for various reasons. When a student is classified at risk due to family income, the student benefits from the schedule flexibility offered by schools. There are times when a student needs to work while still in high school to help their family financially or to support their own family (Wagner, 2001). A second group of students who may or may not fall under this same group are those who are homebound such as in the case of pregnancy or illness, elite athletes and performers, and dropouts from the traditional school setting also benefit from this (Watson J. F., A National Primer on K-12 Online Learning, 2007). There are students who do not do well in the traditional school setting due to discriminatory factors or difficulty interacting with peers. Computer /online learning opportunities allow them to work independently and free from the issues they faced in the traditional classroom (Journell, 2012). A final group that is mentioned in the literature that benefit from computer / online learning are English Language Learners. It is important to note however that ESL instructional strategies must be incorporated into the online curriculum for it be effective (Journell, 2012).

Online Learning for Credit Recovery

One major use for online education is to try to better serve the needs students who are at risk of dropping out of school. Often these students have a history of failing and lack the needed credits for graduation. Computer / online learning offers them a way to make up these credits. This is how such a program is being used at the site of this study, Sunnyside High School. While this is not the only use for such virtual schools, and the advocates of such programs stress that it can be used this way effectively (Watson J. F., A National Primer on K-12 Online Learning, 2007).

The research on the effectiveness of computer / online learning for credit recovery suggests that there is more to the success of the program then just the computer program. It is the use of such programs combined with other strategies that lead to students recovering the needed credits thus allowing them to graduate from high school. Combined with the strategies listed above, mainly teacher interaction, positive results in credit recovery have been achieved. Students who have dropped out of school, who have failed courses, or who need to pass state exams all benefit from online learning. Offering credit recovery is not new to schools. It is the offering of this through online learning that is growing (Watson & Gemin, Using Online Learning for At-Risk Students and Credit Recovery, 2008).

Strategies that Work with at Risk Students

From the strategies that are successful for all students a specific subset have been identified as useful for at-risk students. Strategies that work for at-risk students are focused on three components: connection to an adult; individualized instruction based on ongoing student assessment; and communication with the student's family (Archambault & Diamond, 2010). For

example, Archambault & Diamond (2010) use the term connection to an adult when serving students who are at risk which appears to be similar to Bell & Federman (2013) use of the term interactivity. Their use of the phrase ongoing student assessment overlaps with the description of the role of the teacher in the blended model described by Watson (2008). The Archambault & Diamond component useful for serving at-risk students, communication with student's family, does not appear to be a major component advocated by previous research. These three components (connection, individuation, and family communication) will be discussed below as they apply to serving the students targeted in this study who are students at-risk for academic failure, not graduating. While other strategies or components are needed for computer / online learning to be successful, these are the strategies that are found to be most effective when targeted for at risk students.

Professional development to assure a quality program is one component cited in multiple articles that discussed strategies for successful online learning with at-risk and not at-risk students. Teachers not only need to be skilled in instructional strategies, they must also understand how computer / online programs work (Watson J. F., A National Primer on K-12 Online Learning, 2007) (Martine Pellerin, 2012) (McFarlane, January 2011) (Archambault & Diamond, 2010) (Journell, 2012) (Quillen, 2012). A second critical component to a quality program is related to the pedagogy and curriculum. Whether referring to the traditional classroom or to computer / online learning, quality instructional practices are an absolute (McFarlane, January 2011) (Martine Pellerin, 2012) (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008).

Connection to an adult:

Successful online models with at-risk students have adults who take a direct role with the student throughout their involvement in an online program. One approach used was a coaching team which provided academic and emotional support to the student. Regular communication with all members of the coaching team allowed them to be available when needed whether academically or emotionally (Archambault & Diamond, 2010). Other programs for as-risk students includes the use of computer labs with highly qualified teachers who work with students one to one while the online program provides the course content (Watson & Gemin, Using Online Learning for At-Risk Students and Credit Recovery, 2008).

Individualized instruction based on ongoing student assessment:

Volusia County Schools, Florida is an example of how pre-test and assessments are used to determine where the student is academically in a course. Teachers then develop an individualized plan for the student. They then tutor and coach students through difficult content area and monitor progress throughout the course (Watson & Gemin, Using Online Learning for At-Risk Students and Credit Recovery, 2008). Hope On Line Learning Academy (HOLA) in Colorado and Learn at My Pace (LAMP) in Minnesota, utilize technology that alerts the teacher to academic gaps. With this information, intervention is provided in one to one or small group face to face settings (Archambault & Diamond, 2010). The individualization for at-risks students builds confidence and success.

Communication with the student's family:

When schools using online programs with at-risk students were asked what made their program successful, besides the two strategies discussed above, the third was communication

with the student's family. Student progress, clear expectations of the student's responsibilities, and the benefits of the student's participation in the program were shared with the student's family. Commonwealth Connections Academy in Pennsylvania credited working with parents so that they openly discuss their children's learning problems as one of the strategies that has led to the success of their at-risk students (Archambault & Diamond, 2010).

At-risk students are benefiting from online / computer learning when used with specific strategies. The blended instructional model as used at Sunnyside High School includes some of these strategies, specifically the adult connection and ongoing assessment. Online learning for credit recovery and increased graduation rates is part of the future of for at-risk students.

Summary

Online education is not a replacement of the traditional classroom. At its best it performs on par with the traditional classroom setting of instruction. If care is not taken in the implementation of online instruction, both in the design of the curriculum and training of teachers, as well as the management of facilitates and resources, then this mode of instruction will not succeed. Online education has new cost the balance out the saving of qualified staff, but it would be a false hope that you can replace trained staff and have a successful program.

If this model of instruction is to work, then the need for face to face interaction is essential. Called the blended approach, adult interaction is seen in all successful programs reviewed for this paper. This interaction between educator and student while sharing a few similarities with the role of the teacher in the traditional classroom has new dimensions to it. It requires that teachers think differently about their roll, more as guides and mentors then disseminator of information, and to do this they need to be trained and supported in this new roll

at all levels within the educational hierarchy. So not only do teachers have a role to play in successful implementation of online education, but so do administrator to insure that resources are provide and facilities are adequate.

It important to remember that these are still students taking these classes and they need to be supported and motivated to insure they complete the course work. This is especially true when using these programs in the education of at risk students. At-risk students who are in danger of dropping out and/or lacking needed credits to graduate do not always demonstrate the characteristics of highly motivated or academically prepared students. This needs to be taken into consideration when these programs are used for their educational success. The educators' interaction with at-risk students is important to make sure they stay engaged in the course work and make progress towards completion.

Chapter III

Methodology

Given what the published literature has to say on the impact of computer assisted learning, different types of computer directed instruction, and how to compare this learning to the traditional classroom, this action research was designed to include the collection and analysis of data and address the limitations in the study. Before discussing the methodology of the study, it is worth recalling the purpose of this research. The intent of the research was to analyze if there was any difference in the learning outcome between the use of APEX as an instructional tool compared to the face to face instruction in the traditional classroom.

In studying this, two questions guided the research:

- Is there a difference in student learning in math achievement between computer directed instruction and classroom instruction?
- What is the student perception of academic achievement between the two settings?

This study was conducted at Sunnyside High School, during the spring term of 2013. The study focused on two groups of students, both earning credit for Algebra I. To answer the research questions listed above, three instruments were created; an assessment, a survey, and demographic form. A coding system that maintained students' anonymity and tracked students' voluntary participation and personal data was used to record student learning, thus keeping student scores separate from their identity. The research was done near the end of the last trimester of the course. Inferential statistical methods, student t-test and ANOVA, as well as descriptive statistics were used to compare the two groups and determine if there was any correlation among demographic data, perception data, and the students' learning.

Setting

The study was conducted at Sunnyside High School, in Sunnyside, Washington. This is a rural community located on the eastern side of Washington State in the middle of Yakima Valley. The Yakima Valley is the major agricultural center of Washington State, having the highest gross output of agricultural goods of any county in Washington. Sunnyside is the largest town, ~16,000 (US Census Bureau, 2015), between the larger cities of Yakima and the greater Tri-Cities area. The majority of the business in Sunnyside are unsurprisingly agricultural based, with a high focused on dairy, hops, grapes, and fruit trees.

Sunnyside High School.

Sunnyside High School is a school in transition. With a historically low graduation rate, the last three years have seen a dramatic increase in the graduation rate, from 49% in 2009 to 85% in 2013 (OSPI, 2015). Over ninety-eight percent of the student body is on free and reduced lunch, with an 87% Hispanic student body (Sunnyside School District, 2012). District wide the numbers are 91% Hispanic and 86% on free and reduced lunch (OSPI, 2013).

In 2010 Sunnyside High School was awarded a SIG, School Improvement Grant, and as part of that had the choice of either replacing the administration or replacing the faculty. Sunnyside School District chose to bring in Dr. Salina, from Gonzaga University in Spokane, Washington, as the new principal. The expertise of the existing faculty and staff along with a realignment of values by letting practices shape belief, the hard work of Professional Learning Communities, and an extended day, the school was able to bring about extraordinary increases in graduation rates (Bates, 2015).

Sunnyside High School is on a trimester system. Students taking five classes a day, each for half a credit, with a new schedule every twelve weeks. This allows a student to earn up to seven and half credits in a school year. Twenty-one credits are required to graduate from high school with all but five and half of those credits coming from prescribed categories.

With the trimester system, a student can potentially earn as many as 30 credits in their high school career. This allows for upper-class students to make up credits that they failed to earn earlier in high school. This can be by retaking the class again, or in a credit recovery class for those that have many credits they need to make up. For those students needing a credit recovery class, APEX is the chosen vehicle for credit recovery. Credits earned in this fashion count towards graduation, but do not count towards the student's GPA. APEX computer program was already in use at Sunnyside High School prior to the change in administration.

As stated earlier, the study focused on two different groups of students who were both earning credit for Algebra I, but in two different settings. One set of students received instruction in the traditional classroom and the second set received instruction from a computer based program, APEX, with a teacher assistance available as needed.

Traditional Classroom.

Algebra I is a required credit for graduation. Traditionally this course is taken in the freshman year of high school, taught in the traditional classroom setting with face-to-face instruction. Some technology may be used to enhance instruction, but the teacher does the majority of teaching. (Of interest, it should be noted however that a sizable minority of students take this requirement in middle school, with their credits transferring to high school). The class is broken down into an A, B, and C section. To gain full credit, two of the three trimesters much be

passed. So while a student only needs to pass two of the three trimesters to gain the required credit, credit recovery requires enrolling in all three trimesters.

It should also be noted that the students need to pass a state mandated End of Course, EOC, exam in Math, either Algebra or Geometry. All students enrolled in Algebra I will take the EOC exam near the end of the Algebra I course. Students who take Algebra I in 8th grade take the math EOC at the Middle School.

One factor in this study was curriculum. The math department has a top down leadership at the time of this study, and a curriculum design that insured that all teachers where teaching the same curriculum. So even though the students for this study were drawn from different teachers, they would have all been instructed in the same content. This allowed for the evaluation of the curriculum; not any individual teacher. All the students pursuing credit by APEX by default had the same curriculum.

A second factor was the available technology found in the math classrooms. With the completion of a major renovation of the high school, most math teachers are clustered together in one wing of the building. The rooms are new, with large white boards, one with a pre-marked coordinate system, on both the front and back wall. The technology found in the math classrooms at SHS is basic. The technology in each room includes an overhead projector mounted in the ceiling, as well as a built in microphone and speaker system. Some teachers in the math department also have access to a Smart Board technology. The majority of the teachers have a limited set of graphing calculators, as well. Thus the face to face instruction follows the traditional instruction found in non-blended classrooms.

APEX Classroom.

Not all students gain credit for Algebra I on their first attempt. A great deal of effort has been placed into improving the passage rates not only at Sunnyside but nationwide. One tool that Sunnyside High School has is APEX. APEX is a third party online tool that provides instruction in high school coursework. Through this venue, a student working at her own pace, can make up credit with the completion of required course work online.

While it is possible for a student to work on APEX from any computer with an Internet access, the majority of students who work on the credit in this manner, do so in the credit recovery computer lab. This is a room located in a portable building on the campus of Sunnyside High School housing about twenty-five computers. During any period of the day there are at least a quarter to a half of all the computers occupied with students in a credit retrieval class. During the course of a class, one teacher monitors the students' progress online, while there is at least one to three teachers or paraprofessionals there to assist the students if they need additional help in the coursework. In addition to this, the computer lab is made available to students after school to work on making up credit.

APEX has a wide variety of courses available for the student to take, with the majority focused on core high school classes, but also a finite number of, Advance Placement, AP classes as well. This study only looked at those students enrolled in the Algebra I online course, which in the APEX course is laid out in two sections, I and II. While not a perfect overlap between the course of Algebra I at SHS and the APEX Algebra I class, in terms of standards taught, there is enough to compare similar elements in both offerings.

Participants

For this research, I looked at two populations at Sunnyside High School. One group of students took Algebra I in a traditional classroom, and the second group of students received Algebra I credit through APEX after not passing in the traditional face to face classroom. Working towards credit in Algebra I is the common thread between these two student's groups, as well as the need for the students to take and pass the End of Course Geometry or Algebra state mandated exam.

Participating student in the traditional classroom.

The majority of students in the traditional classroom are freshmen. In this setting the students will have one teacher for the entire instructional time, in a brick and mortar classroom. This group can further be broken down into two subgroups; students who are taking the class for first time and students who were re-assigned to the class due to failing grades in the previous year. Student retaking the class for the second time might also include students who took Algebra in the middle school level and did not receive credit there. Given that students need to pass one or the other of the two End of Course math exam, freshman enrolled in Algeria I will be taking the Algebra EOC.

Students in the traditional classroom group were selected from my freshman science class who were also enrolled in Algebra I at the time. There were 38 students from this group who filled out their consent forms and were used for this study. The students in the traditional classroom received their instruction from both a textbook and curriculum developed by the Algebra I team. This was a teacher-focused room, with the teacher at the head of the class leading instruction.

Participating students making up credit through APEX.

The second group of students were in the credit recovery program and making up their Algebra I credit on APEX. Non-traditional classrooms students who were invited to take part in the study came from a list of students who had earned Algebra I credits thought APEX. At the time of the study only 4 students were found who had completed Algebra I on Apex who returned their consent forms indicating their willingness to participate in the study.

A student instructed in this setting looks dramatically different than a student in the traditional classroom. The student sits in front of a computer for the whole period and never listens to a classroom lecture. Students work independently and set their own pace along with having the asset of being able to work during the scheduled class time as well as after school or on weekends.

Many of the students using APEX for credit recovery are also students in the intervention program at Sunnyside High School. The intervention program is designed to help students graduate on time by providing the structure and support to regain deficient credits. The intervention program offers a smaller class size, more individual support, and ready access to APEX, in an effort to help students become academically successful and make up lost credit. Unrelated to this study,-there are also students at Sunnyside HS who are not in the Intervention Program but who are using APEX classes to gain credits. Mostly these are upperclassmen students who come in after school to use this online curriculum. This is similar to some studies used for this research where students gain credit through computer online courses.

Research Design

This study used quantitative data from three sources: a summative assessment on algebra, demographic data, and a perception survey about the method of instruction the student received. The instruments created for this research were designed to provide these data sources and answer the research questions on the differences in performance and perception between the two groups of students. The summative assessment was used to determine differences in student learning and a perception survey to determine if there was a difference in how the students perceived their learning.

Descriptive statistics were used to evaluate each group of test takers and a student t-test was used to see if there was any statistical difference between the two groups. A t-test was also used to see if there was any statistical difference between each individual class and the group as a large.

With the perception data, the scores were grouped with all the scores that responded similar to each of the five perception questions. Then an ANOVA test was used to see if there was any statically difference between the perception response and the overall score on the exam.

Instrumentations

Various forms were created for this study. Forms were developed to collect data and information as well as a consent form. There were three instruments created in order to answer the two research questions: is there a difference in learning between online instruction and the traditional classroom, and what the students themselves thought about the method of instruction that they received. Those instruments were a math assessment, a perception of math survey, and

a demographic data form. Along with this a permission form was also created for the ethical considerations of getting consent from the subjects for their participation in this study.

The summative assessment.

In order to assess the first research question, on the comparing the two academic achievement of the groups of students, a summative assessment was created. This was a sixteen multiple choice question test, covering topics from three Washington State Standards in the Algebra I curriculum. Half the question came from the SHS Math Department, and the other half came from APEX question. In the design of the assessment that the students took, care was taken to make sure that State Standards that were assessed where covered and assessed in both the traditional classroom as well as APEX.

The math topics that the assessment covered were representation of a function, solving 1st order polynomials, liner equations, and solving system of equations. Each topic covered was clumped together on the assessment with a question pulled from the APEX assessment followed by a question from the SHS math department, or vice versa. In this way it was assured that the questions assessing each of the three topics was covered from both sources being tested. This also insured that the assessment had multiple questions covering the same topic.

The perception survey.

The second instrument created was a perception survey for the students to fill out about their educational experience. This document asked each participant to rank on a four-point scale: their enjoyment of the method of instruction, their engagement in the method of instruction, their perception of how well they learned the math curriculum, their overall enjoyment of math, and their view of the importance of math toward academic success. The four-point scale for scale

was adjusted to fit each question but followed the same pattern to record their feelings. The scale was set out in the following pattern: 4 - a strong negative, 3 - a mild negative, 2 - a mild positive, and a 1 - a strong positive response. Special care was given to wording the questions so the responses made logical sense while also ensuring that wording of the agreement statement was consistent between the five questions. (Appendix B)

The questions were designed to cover major factors that reflected the efficacy of the students in their math class and that efficacy effect on their performance in the math class. In this way it was hoped that a relationship between student perception and math performance could be discovered. By giving the students a four-point scale, rather than a neutral middle position, they would be forced to rank their perception in a positive or negative light.

The demographic data form.

The last tool that was created was a Demographic Data Form, which was filled out for each student that participated in the study. This was done to help answer research question two, whether certain demographics do better in one setting over another. One of the most telling data information was, social economic status, which was deemed too hard to collect, but would be interesting to look at for future research. The form was designed to record the student's age, grade level, whether they were an English Language Learner or student with identified special need, their overall GPA, gender, and math academic history. This form was filled out by a counselor or teacher using school records.

Discussion of the parent assessment form.

The parent consent form was created so that students and parents could decide if the student participated or not in the study. The form simply told parents who I was and what the

assessment was going to cover. The form stressed that participation was totally voluntary and that there was no penalty for not participating. It also informed them that individual student results would be held with strict confidentiality, but the synthesized results would be used and could be published. At the bottom there was a space for the students and parents to opt in or out of the study.

The form was number coded to the assessment and perception survey so that these two forms would contain no identifying information, and to make it easy to correctly decide which forms should be included in the study and which should not because of lack of consent. This code was also used to tie the demographic data to the other two parts of the study.

Only one student chose not to participate in the study. In addition, a small handful did not return or opt out of the study, their test results were not tabulated and the results not used in the study.

Consideration of validity and reliability in the study.

In order to insure the validity of the assessment, a limited but representative number of topics were selected to assess the students' understanding of math. These questions were selected to address the first two research questions, thus insuring their validity. The Perception survey questions only addressed academic achievement in math thus ensuring the validity of this instrument. This was all in accordance to Mertler, (Mertler, 2012).

Reliability of the assessment questions was insured by choosing well-worn question from both the Sunnyside Math Department and Apex. These question have already been used multiple times to reliably assess the topics they address. The perception questions were administered to

multiple students to insure that trends in the student's responses could be spotted. Again this was all done in accordance to Mertler, (Mertler, 2012).

Data Collection

The participants were given the assessment, which included the Standards of the Algebra I curriculum. I administered the assessment near the end of the trimester so that the units on the assessment had been covered by the Algebra I teachers. During the same time frame Ms. Driesen administered the test to those students in credit retrieval who had finished Algebra I credit sometime during this year, and were both willing to participate and returned the parent consent form.

The summative math assessment tool.

How and whom administered?

For the freshman students, group one from traditional classrooms, I administered, collected, and scored each of the tests. I also tabulated the scores from the assessment. For the freshman group the assessment was given in my room to each of my freshman classes late in the school year during the last trimester.

For the second group, students earing credit on APEX, Ms. Carmen Driesen, the paraprofessional in the Credit Recovery room, administered the test. She then collected the tests and returned them to me which I scored and tabulated the results. During the same time frame as I assessed the students in group one, Ms. Driesen administered the assessment to the APEX students.

What was collected?

The assessment was designed and administered to answer research question one, about the different in math achievement between the two groups. There were sixteen questions on the assessment, each worth one point with a few question having the possibility of partial credit. The math topics that the assessment covered were: representation of a function, solving 1st order polynomials, liner equations, and solving system equations, with equal number of question coming from both the math department as well as APEX assessment.

The perception survey.

How and whom administered?

For the freshman students, group one from traditional classrooms, I administered, collected, and scored each of the test. I also tabulated the scores from the assessment. For the second group, students earning credit on APEX, Ms. Carmen Driesen, the paraprofessional in the Credit Recovery room, administered the test as their attendance allowed her to give them the packet. She then collected the test and returned them to me which I scored and tabulated the results. This was administered at the same time as the summative assessment.

What was collected?

The perception survey was administered in order to address the second research question to see if there was a perception difference between the two groups and if the students' perception affected their performance. This survey had two parts. The first part asked five questions in regards to their perception and the second part asked the students to self-report their current GPA, class rank, math academic history, and a space for them to record anything else about their

math experiences at Sunnyside. The questions covered areas of study efficacy (enjoyment of instruction, engagement on instruction, self-assessment of learning, enjoyment of math in general, and view on the usefulness of math) that might affect their performance in math. The students responded on a four-point scale from strong positive feelings to strong negative feelings. The wording for the students who were making up their credit thought APEX was change slightly to reflect their perception of the computer aided learning environment as opposed to the traditional classroom.

The demographic form.

How and whom administered?

The demographic form was to be administered in the same time and place, and by the same people, as already described above. The only change in the procedure, from tabulating the results right away, was that after the students had returned their consent forms, then the school databases were going to be used to look up the demographic information by the teacher and school counselors, using the access privileges they already had as the student's teacher and school counselor. By the time the study got around to this, access to this data was no longer available, and the demographic form was left incomplete.

What was collected?

Once consent to participate in the study was obtained, then information on the student's age and her current GPA was collected from the school record system. In addition, to see if there was a link to their Academic Math History a list of the teachers and the student's grades going back to 7th grade was recorded. The last part of the student's demographic background that was

collected was whether the student had any English Languages Learner, ELL, designation or had qualified for any special service or needs, and if they had a current Individual Learning Plan, ILP.

Ethical Considerations

To insure anonymity of all test takers, all documents were given a three-digit code. The first, a letter, identified which group the test taker belonged to, and the next two numbers, in the code, identified each individual test. Each test packet handed to each student contained a cover page, demographics sheet, the assessment, and math perception survey and on a separate piece of paper, a consent form. On the cover page was the only place in the packet handed out that the student placed their contact information which was used only for tracking down consent forms. As the corresponding consent forms was returned, the cover page was removed from the rest of the packet and secured. In this way the results on the exams where tabulated separately from the student's identity.

All confidential documents were shredded and properly disposed of at the end of the study. During the study, these documents were kept locked in my room in a secure location.

With respect to permission and confidentiality the following was done: in accordance with Gonzaga University, a training course from the National Institutes of Health (NIH) Office of Extramural Research titled "Protecting Human Research Participants" was completed by the author and researcher on June 8, 2012 (Appendix C). Through the Gonzaga University Internal Review Board (IRB), approval was granted (Appendix D) regarding the proposed action research project and the data collected for the project. The Sunnyside School District superintendent's approval was granted along with written approval from the principal of Sunnyside High School

(Appendices E & F). Parent permission (Appendix G), along with student consent (Appendix H), was obtained for each student participant who filled out a mathematics perception survey.

Implementation

- Come up with research question.
- Develop and write perception questions.
- Pick demographic data that is meaningful and can be gathered.
- Write demographic form.
- Decide the target groups.
- Pick Math standards to asses, by checking for overlap between APEX and SHS curriculum.
- Find common problems between both groups.
- Write assessment.
- Administer assessment to my freshman classes.
- Collect permission returned consent forms, include data in study.
- Destroy any data without consent form.
- At the same time, give stack of forms to Ms. Drisen to administer.
- Ms Drisen find qualifying students and ask to participate in study, and administers assessment.
- Again if have returned consent for use data, otherwise destroy.
- Collect demographic data for each tool packet, then detach first page with identifying information. Store in secure location.

- Grade and tabulate the assessment and perception survey results in to an spreadsheet.
- Data analysis to see if there are trends in the data, and if there is any variance between the groups.
- Publish results.

Data Analysis

Descriptive statistics, mean, median, standard deviation were generated to evaluate the students' assessment results. An independent t-test was run, at 0.05 level of significance, to see if there was any discernible difference between the math achievements of students instructed in the traditional classroom and those who received their instruction online through APEX. The difference between the students' perception between the two groups was also calculated.

The students' scores on the assessment was paired to the responses to each of the perception questions. An ANOVA test was run against each perception question to see if the students' perception of math has any effect on their assessment score.

Lastly ANOVA statistical analysis was going to be run against each of the demographic data as well as the survey answers to determine if any part of the student's background could predict better learning outcomes from a particular learning environment. This part of the Analysis was not done, because that data ended up not being fully collected.

Limitations

One of the major limitations of this study was the difference in age, grade level, and exposure to Algebra I of the two groups. It would have been to better match the profiles of the

two groups of students to create two more equal groups. By the nature of the use of APEX at SHS, students in this group have failed Algebra I taken in the traditional classroom and are enrolled in the online credit recovery class to gain the needed credit to graduate as opposed students in to the other group who are first time takers of the course instructed in the traditional classroom. Secondly, the APEX student group is more likely to be upperclassmen as it is the second time they are taking the course, while the traditional classroom instructed group are freshmen, as it is their first time to take Algebra I.

Ultimately the number of participants of the APEX group of students was too small to state with any confidence if there was a difference between the two groups.

Summary

A collection of three tools were generated and the data was collected. Care was taken in this whole process to make sure that student's anonymity and privacy was preserved.

Using statistical methods like student t-test and ANOVA were used to see if there was any statistical difference between student’s response and their scores. Unfortunately, the plan to collect demographic information did not materialize, and that analysis could not take place. After the descriptive and inference statistics were run, the data was scrutinized to understand why or why not there was a relationship within the data.

The lack of many participants from the credit recovery side of the study is a major limitation here as well as the failure to collect demographic data.

Chapter IV

Results

The purpose of this study was to analyze computer directed instruction as compared to in-class instruction, specifically in regards to math achievement. Two groups of students were compared in this study: a group of 38 students who had completed two trimesters of traditional instruction in Algebra I, and 4 students who had completed Algebra I using the APEX Algebra I course. The students' scores on an assessment created for this study were compared, as well as their response to a perception questionnaire.

The math assessment questions given to the students was composed of fifty percent from the Sunnyside High School math department and fifty percent from APEX. The scope of the questions on the assessment covered three state standards. Overall findings in this study showed students using APEX score lower than students in the traditional instruction setting. However, due to the low numbers of APEX students participating in the study, it is hard to draw a decisive conclusion. In regards to perception data there were five questions asked, and only two questions showed any evidence that the students' scores when linked to their perception responses were statistically different from each other.

Brief Word on Statistical Methods

The two statistical tests that I used for this study were student t test and ANOVA. Both use *p* values to see if sets of data are statistically similar to each other. The key thing about these test is that they only answer the question if the data is similar to each other, not if one is greater or less than the other.

The use of *p* values has been in the news of late, with their use being banned by professional journals (Woolston, 2015). The *p* value is used to compare data against what random results would look like, not whether or not the data is correct in the first place. This subtle difference is one that should not be overlooked. When *p* values were used in this study, they were used to determine whether or not the mean values of the data were statistically equivalent.

Research Questions:

- Is there a difference in student learning in math achievement between computer directed instruction and classroom instruction?
- What is the students' perception of academic achievement between the two settings?

Difference in Student Learning

The main focus of this study was to determine if there was a difference in learning outcomes between the two groups. As stated in the related research question, is there a difference in student learning in math achievement between computer directed instruction and classroom instruction? The scores of the students who earned their credit though APEX were noticeably lower than their peers. Unfortunately, as the number of APEX students who participated in the study was very small compared to the students who received traditional instruction, the results are still inconclusive.

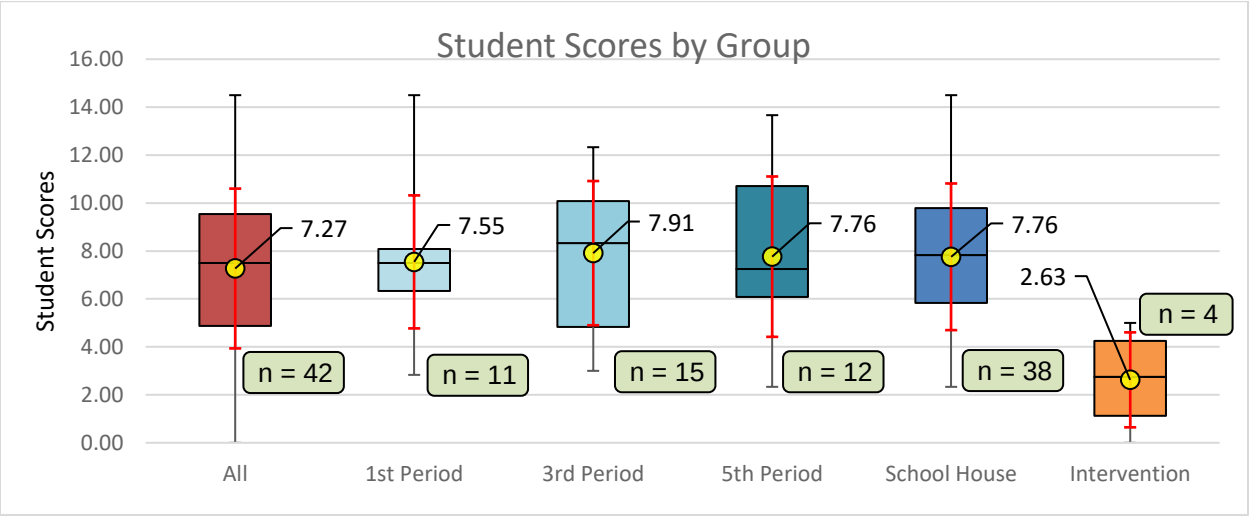

Figure 1 This is a summary of the student score on the math assessment, broken down by grouping. This average is represented by the yellow ball, while the colored box and black bars represent your standard whisker box plot (range, median, and quartiles), while the red error bars represent the standard deviation of each data set.

As can be seen in the graph above, the main student body had an average score of 7.8, a standard deviation of 3.1, and a median score of 7.8. In contrast, the four APEX students had an average score on the exam of 2.6, a standard deviation of 2.4, and a median score of 2.8. It should be noted that in the APEX group there was one of student who did not get a single question correct, a score of zero.

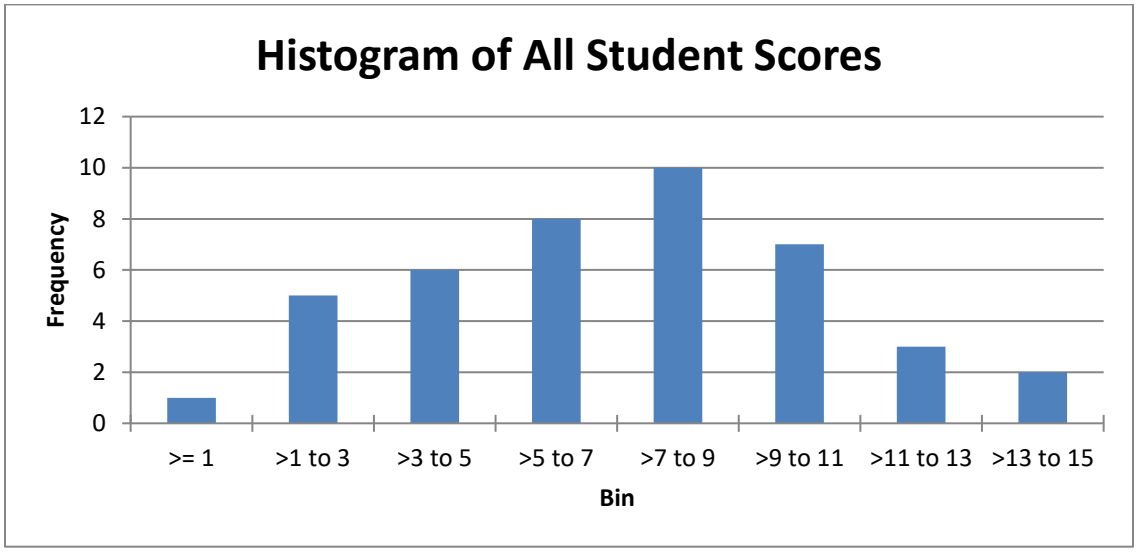

Figure 2 The distribution of student scores in to three point bins. A total of 42 assessments where used; note the bell shaped distribution of the scores.

When looking at the whole student population, their scores fell mostly in a bell curve distribution; this gave confidence in using statistical methods based on normal distribution. The 42 total students who participated had an over-all average of 7.3 with a standard deviation 3.4 and a median score of 7.5.

Statistically comparing student's groups scores.

A student t test was run comparing the traditional instruction student scores to those of the students earning credit through APEX. Students who received credit though APEX had a lower score (M = 2.63, SD = 1.88) on the assessment then the main building students (M = 7.76, SD = 2.45), $t(4) = 4.109$, $p = 0.015$.

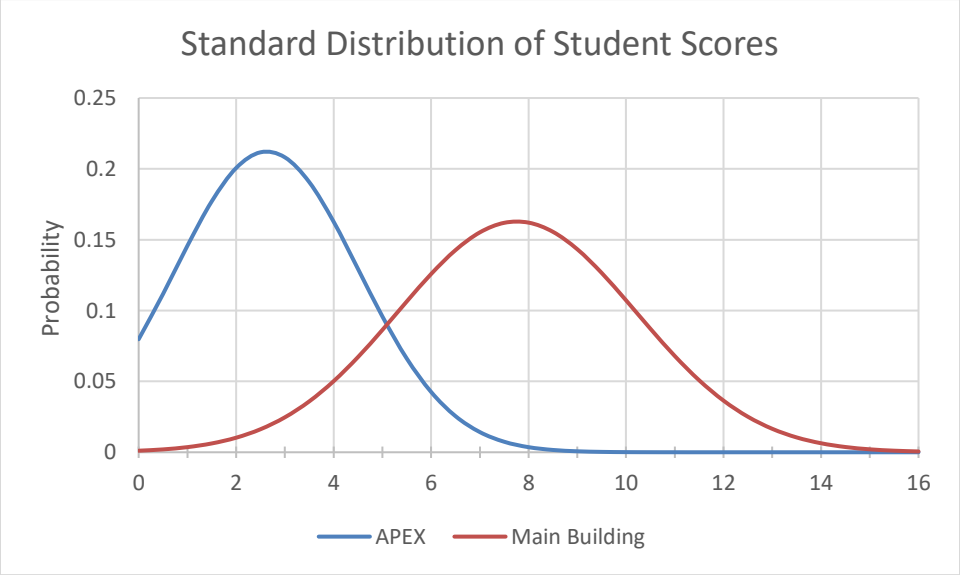

Figure 3 This graph shows a normal distribution of the two groups' scores based on their mean and standard distribution. It is clear from this graph that the mean of each group lies way apart from at least one standard distribution from each other. It is a pretty safe bet that these two groups are statistically different.

Looking at the *p* value for the two tail tests shows that there is a 1.5% chance that these two groups are statistically similar. It should be noted again that only 4 students earning credit though APEX were found for this study.

Perception Data Results

The data will be presented in relationship to each of the five perception questions:

- Q1: How well did you enjoy the method of instruction?
- Q2: How engaged were you in your math class?
- Q3: How well did you learn the curriculum taught?
- Q4: How much do you enjoy math, not just inside your math class?
- Q5: How important do you think math is for academic success?

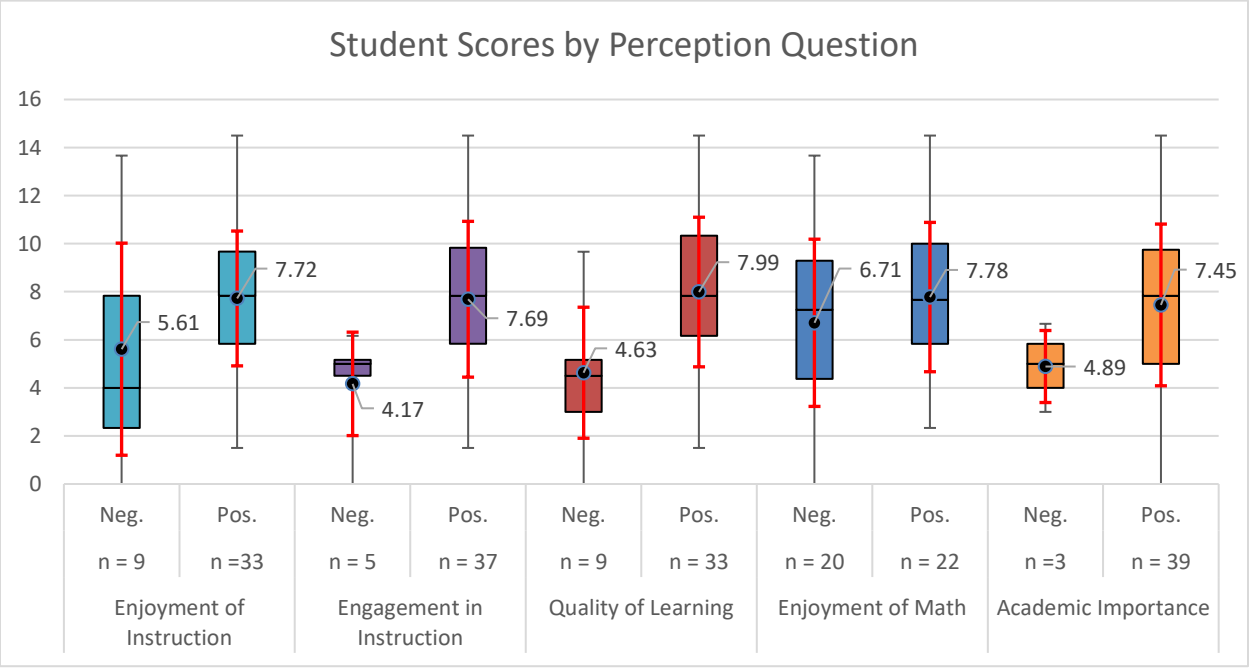

Figure 4 Whisker & Box plot of the five perception questions broken down by student scores and positive or negative answers to the questions. The bar in the middle represents the median, the dot represents the average of the data, and the red line represents the standard deviations. On visual inspection, and back up by a t test, only two questions were statistically different.

From this graph, only the question of engagement in the instruction and quality of learning appear to be different from each other. This is further backed up by a t test. Student's view of academic importance of math appears to have a positive relationship to the student scores at first blush different, but for mitigating reasons discussed later, it was determined that they are probably not statistically different.

Table 1 This table shows the data from the above graph. The sizes of the difference between the averages, when look at within the lens standard deviation is useful to guessing where statistical differences might be. Of particular note is the questions on engagement and also learning.

	Enjoyment of Instruction		Engagement in Instruction		Quality of Learning		Enjoyment of Math		Academic Importance	
	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos
Average	5.6	7.7	4.2	7.7	4.6	8.0	6.7	7.8	4.9	7.5
StdDev	4.4	2.8	2.2	3.2	2.7	3.1	3.4	3.1	1.5	3.4
n	9	33	5	37	9	33	20	22	3	39

The general trend was that most student's responded with one of the two positive answers other than the two negative options. The only place where the student's two answers were split evenly was in question four about their overall enjoyment of math. While none of the averages, of the student scores, were equal to each other, with the closes being only a point apart, this illustrates why it is important to look at the distribution of data as well as averages. This can be seen when looking at the graph above.

The next section will present a graph that breaks down the data for each question, followed by an analyses of the significance and importance of this data. It should be notated that

the dot in each graph represents the mean of the data, while the box and lines are a standard Whisker and Box graph showing the median as well as all four quartiles.

How well did you enjoy the method of instruction in your math class?

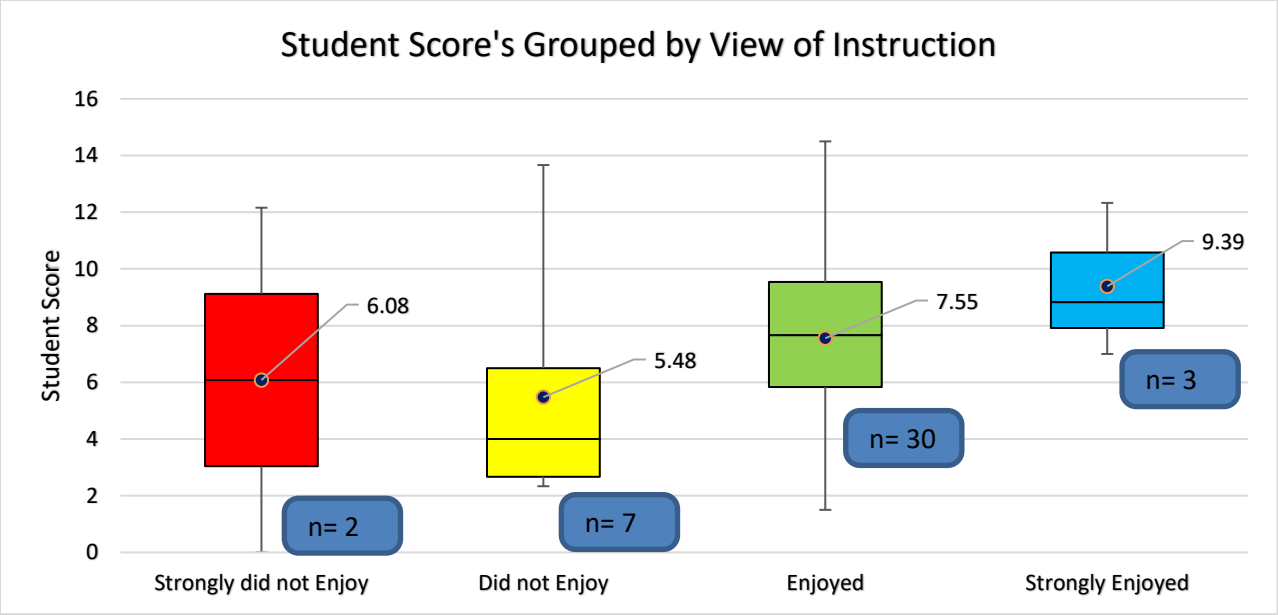

Figure 5 Student enjoyment of math class compared to their scores on a math assesment. Student scores broken down by the four available responses to enjoyment of instruction plotted versus student scores. The dot represents the mean of that response and the whisker box plot shows the median, quartiles, and range of the responses. Note that the means easily fall within the ranges of all the other responses.

This question was trying to gage the student's enjoyment of the instruction method. This was the first of five question looking at perception. With all these questions, the student's responses from negative to positive were looked at against their overall score on the math assessment.

Of the four participants who earned credit though APEX, half (with scores of 5.0 and 1.5) had a slightly positive response while the other two (scores of 4.0 and 0.0) had a slight negative and strongly negative response. Another interesting point is the top four scores out of all participants each had a different response to this question. These four participants spanned the whole gambit from strong negative to strong positive.

Running a student t-test on the two groups showed that there is a good chance that the two combined groups, positive and negative responses combined together, were not statistically different. In terms of enjoyment of the method of instruction, students reporting a negative response (M = 5.61, SD = 4.41) had a lower score than students who reported enjoying the method of instruction (M = 7.72, SD = 2.81) $t(10) = -1.29$, $p = 0.226$, but looking at these results, the p value for a two tail test was 0.226. This is well above a 0.050 confidence interval. It should be noted that this is not conclusively saying that the groups are different, rather it is more likely that the difference between the means is caused by random differences in the two groups. This is going to be a trend seen in three of the five questions.

When looking at each of the four possible responses, the most popular response was a lukewarm, “Enjoyed my math class”. Thirty responders chose this. Of the two strong negative responses, “Strongly did not enjoy my Math Class”, one was an intervention student who did not score any points and the other was the fourth highest score on the math assessment. It might appear that there is a rising trend of scores as enjoyment went up, but each mean lies very close to the range defined by the second and third quartile. Further analysis by an ANOVA test shows that it is most likely that the means for each group are statistically similar to each other with a p value of 31%.

Table 2 An analysis of the variance between responses to enjoyment to of their math instruction. Students were given four possible responses from strongly negative to strongly positive.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Strong Negative	2	12.16	6.08	73.93
Negative	7	38.33	5.48	16.80
Positive	30	226.65	7.55	8.13
Strong Positive	3	28.16	9.39	7.33

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	41.25	3	13.75	1.23	0.3126	2.85
Within Groups	425.29	38	11.19			
Total	466.54	41				

How engaged were you in your math class?

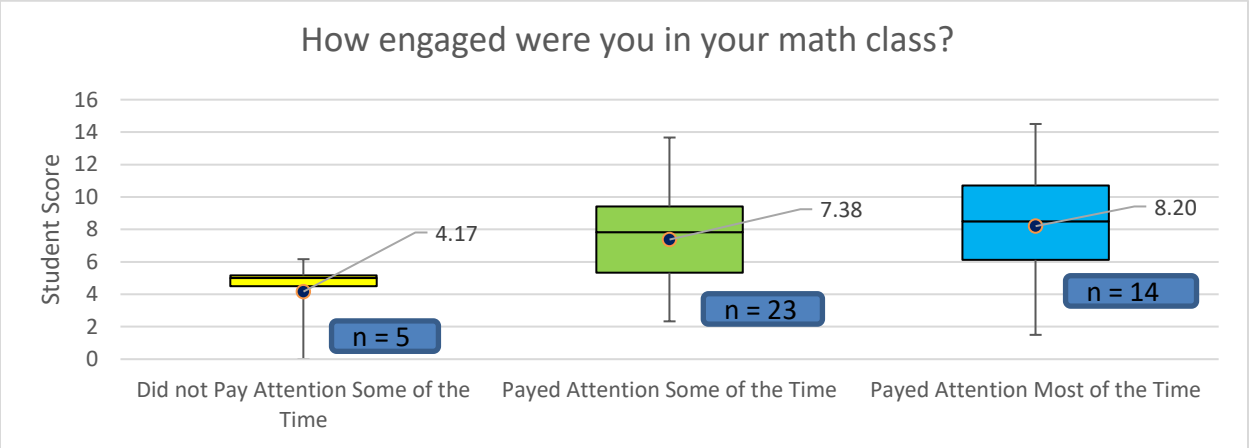

Figure 6 Amount of time studnets reported engaged in class compared to their scores on a math assessment. Student responses are broken down by the four available responses to engagement of instruction.. The dot represents the mean of that response and the whisker box plot shows the median, quartiles, and range of the responses. No students responded that they did not pay attention most of the time.

This question was asking students to rate how much they paid attention in class, with responses ranging from “not paying attention most of the time” to “paying attention most of the time.” It is interesting to note that none of the participants said they were disengaged most of the

time. The majority of the students answered with a positive response to this question, with the high number of responses, twenty-three, said they were engaged some of the time.

The Apex students were split fifty-fifty between positive and negative in their responses to this question. The students scoring 0.0 and 5.0 points responded "sometimes not paying attention," the student with a score of 4.0 responded "paying attention some of the time," and the student with a score of 1.5 responded "paying attention most of the time." When looking at all students positive and negative responses to the question, the students with negative response (M = 4.17, SD = 2.15) scores were lower than students with positive responses (M = 7.69, SD = 3.24), $t(6) = -2.93$, $p = 0.026$. This said with a p value of 0.026, below a confidence interval of 0.050, it is likely that the positive and negative responses do not have statistically equal means. Because there is a positive relationship between how much time the students spent engaged in class and their test scores, it is quite likely that this is a factor in student learning for the whole student population.

While it does appear that there is a link between paying attention in class and performance, the amount of time spent paying attention, some compared to most, did not have a huge impact on the students' performance. This is reflected in an ANOVA test run between the three classes of students' responses returning a p value of only 15%. There is much less conclusive evidence that the results are statistically different than the early p value from the t-test of 3%.

Table 3 An Analysis of the Variance between responses to the amount of attention paid in class. Students were given four possible responses from not paying attention most of the time to paying attention most of the time.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Not, Most of the Time	0	0	#DIV/0!	#DIV/0!
Not, Some of the Time	5	20.83	4.17	5.79
Some of the Time	23	169.65	7.38	8.97
Most of the Time	14	114.82	8.20	14.27

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	60.56	3	20.19	1.89	0.1478	2.85
Within Groups	405.98	38	10.68			
Total	466.54	41				

How well did you learn the curriculum taught in your math class?

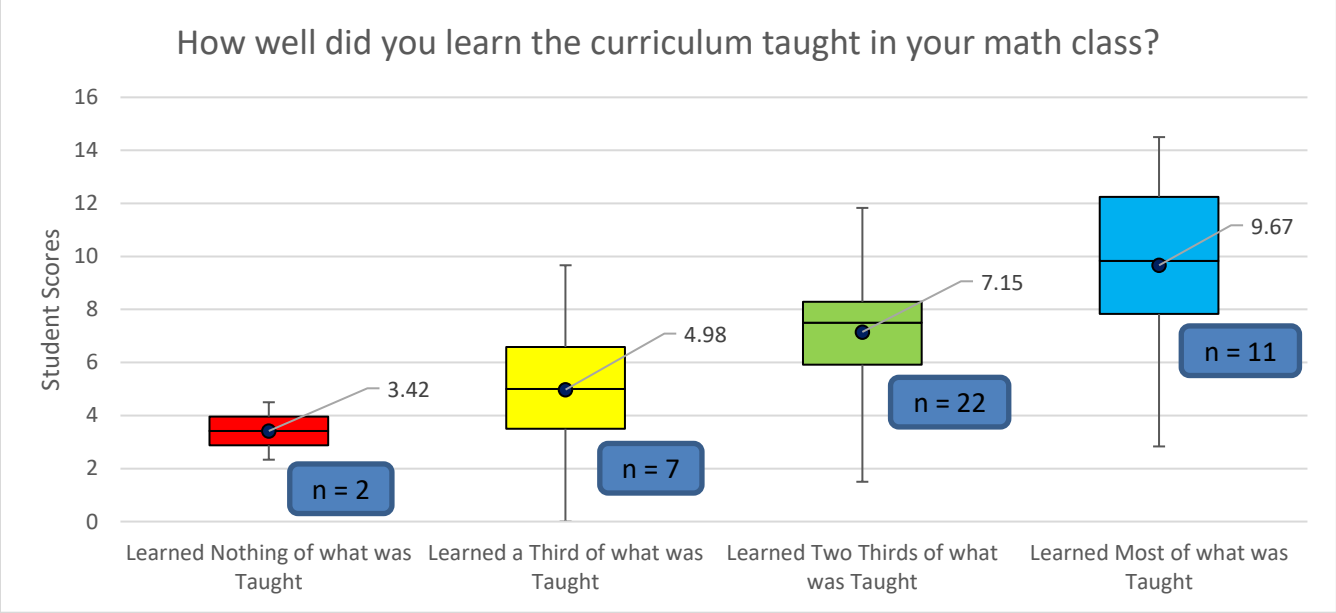

Figure 7 Amount of the currculum that student reported learing compiared to their math scores on the assesment. Student scores broken down by the four available responses to enjoyment of instruction plotted versus student score. The dot repesents the mean for that group. A clear postive trend in the data can be seen, and this is supported by a ANOVA analysis.

The vast majority of the students believed they had learned a majority of what was taught to them. Students with a positive view they had learned the curriculum (M =7.99, SD = 3.11) did better on the assessment then students that had a negative response to how well they learned the

curriculum (M = 4.63, SD = 2.73), $t(14)$ = -3.026, p = 0.009. With P value of 0.009, there is a strong indication of a link. Of the four students earning credit on Apex, the 0.0 and 5.0 score were in the one third learned camp while the 1.5 and 4.0 score were in the two thirds learned camp.

There is a clear positive trend in how much the student believed they had learned the curriculum to their scores on the assessment. In fact, when an ANOVA test was run, the p value that all the groups where statistically the same when compared to random distribution was only 1%. This would make it high unlikely that each group, based on their answers, scores were the same. It would appear that students have a sense of how well they learned the curriculum.

Table 4 An Analysis of Variances between how well the students reported they learned the curriculum in class. The students were given four responses that varied by thirds how much of the material they thought they learned.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Learned Nothing	2	6.83	3.42	2.35
Learned a Third	7	34.83	4.97	10.13
L	22	157.32	7.15	7.14
d	11	106.32	9.67	12.35

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	129.9461	3	43.32	4.89	0.006	2.85
Within Groups	336.5966	38	8.86			
Total	466.5427	41				

How much do you enjoy math, not just inside your math class?

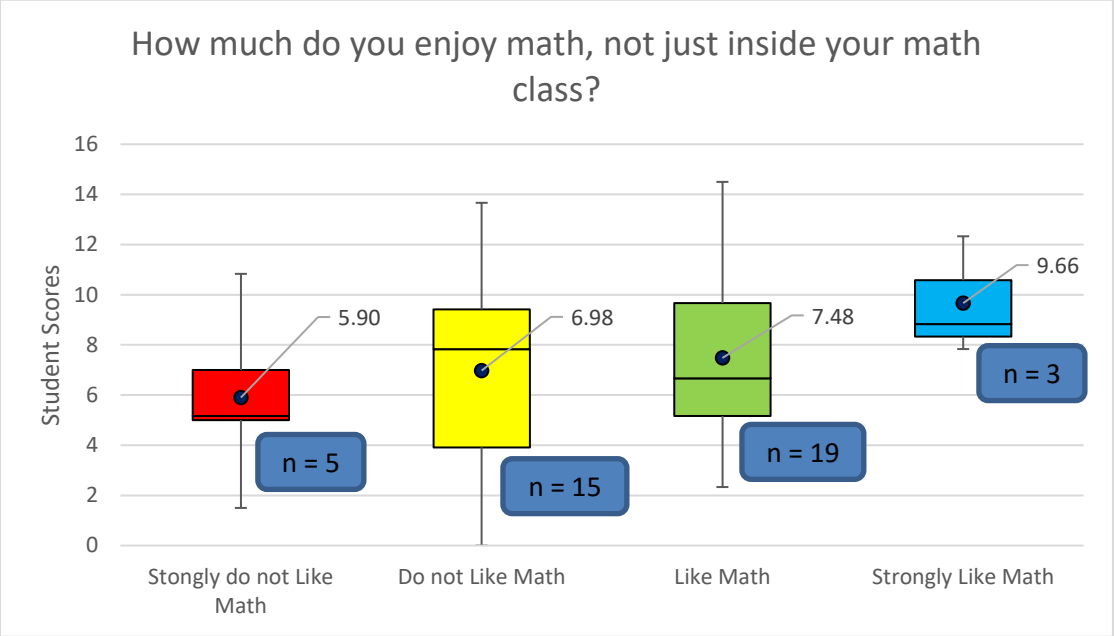

Figure 8 Amount of the currculum that student reported learing compared to their math scores on the assesment. Student scores broken down by the four available responses to enjoyment of instruction plotted versus student score. The dot repesents the mean for that group. The enjoyment of math compared to student scores. Large ranges and many students in the middle two groups dominated this graph.

In this study, the student's enjoyment of math did not have a correlation with their performance on the assessment. The number of students who like or dislike math was almost evenly split. Students who responded negatively (M = 6.71, SD = 3.48) scored only slightly lower than students responding positively (M =7.78, SD = 3.11), $t(38) = -1.023$, $p = 0.313$. A t test analysts show a p value of 0.313 that the two values are statistically similar, well outside of the confidence interval of 0.050. The range of student responses falling into a positive or negative camp were pretty much evenly distributed as well. None of the Apex students reported a strong like of math, and in addition two of them, highest and middle score, reported a strong dislike of math.

While there is an increases in means as you move from the left to the right, with such large spread out ranges, it is more than likely that the student's perception on this question does not affect their performance. A *p* value of 49% goes with this observation.

Table 5 An Analysis of Variance of enjoyment of math, in general, compared to student scores.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Strong Dislike of Math	5	29.50	5.90	11.56
Dislike of Math	15	104.65	6.98	13.68
Like of Math	19	142.15	7.48	10.49
Strong Like of Math	3	28.99	9.66	5.58

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	28.73	3	9.58	0.83	0.49	2.85
Within Groups	437.82	38	11.52			
Total	466.54	41				

How important do you think math is for academic success?

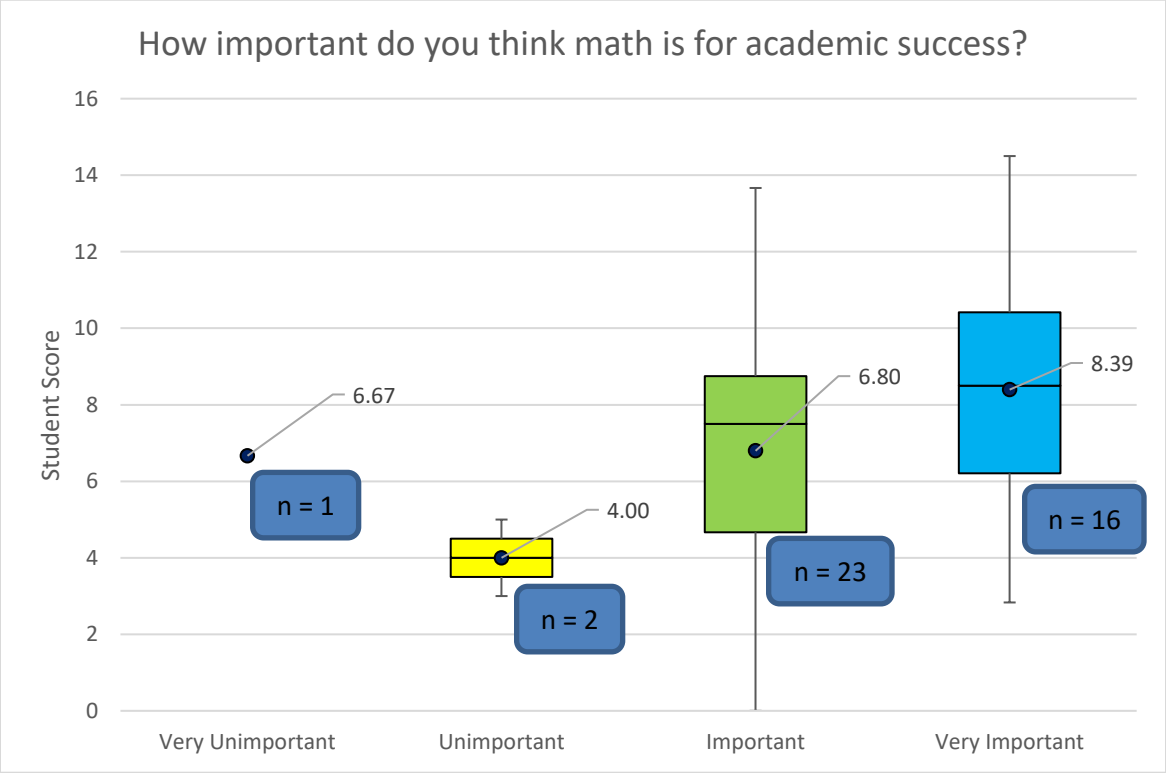

Figure 9 Students' view of the importance of math compared to the scores on a math assesment. Few students disagreed with this statement, resulting in a wide range for both postive responces.

Only three students did not see the importance in math for academic success; one of them being the Apex student who scored the highest. Students that reported a negative responses (M = 4.90, SD = 1.50) had a slightly lower score then positive responses (M = 7.45, SD = 3.36), $t(3)$ = -2.15, p = 0.121. Though the p value is larger than 0.050, it is not much larger, but with so little responses on the negative side, it would not be prudent to draw a conclusion of the difference between the two groups.

Table 6A Analysis of Variance of students' view of the importance of math compared to their scores on an assessment. Note the p value of 25% indicating that it unlikely that the scores are statistically different from each other.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Very Unimportant	1	6.67	6.67	#DIV/0!
Unimportant	2	8	4	2
Important	23	156.32	6.80	11.84
Very Important	16	134.32	8.39	10.46

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	47.15	3	15.72	1.42	0.25	2.85
Within Groups	419.39	38	11.04			
Total	466.54	41				

Some open ended response by the students about their experience in math class.

At the end of the perception survey I asked if they wanted to say anything else about their experience with taking math in Sunnyside, here is a sampling of some of the response that I received. Student responding "no", or "Nope" made up 18 of the 39 response that student wrote down, and my far the biggest trend.

When looking at the four innervation students, the student with the highest score, 5.0, continues to be an enigma with a response of "It was Hollible Becasuse I very Strongly Hate Math!!!!!!!!!" (sic). The APEX students who score 4.0 and 0.0 points both left a non-answer answer. The final comment from the student who score a 1.5 was again a profession of low efficacy, "I don't know much about math" (sic).

Looking at the main student body it is again a mixed bag, with comments about math or it instruction not having much any relationship with the scores the students made. Here I percent

the comments of note alongside that students score. It is important to remember that the median student score was a 7.8.

- 2.3, “there boring”
- 10.8, “Theyre boring” (sic)
- 10.7, “No Except There R some Teachers That Don’t know How To Explain It Well” (sic)
- 9.8, “Nope, well some teachers need to learn how to teach(control) class.”
- 5.8, “most of the math is confusing and under stanable” (sic)
- 3.0, “That its good but should be funer” (sic)
- 5.2, “Yes teacher Should be more istricked about math.” (sic)
- 8.2, “I enjoy teaking math when I understand it which is most of the time.” (sic)
- 12.3, “Its interesting” (sic)
- 10.3, “I have learned that the higher the grade you’re in, the harder the math. Also, the more you pay attention in class and do your work, the faster and more you'll understand it.”
- 7.8, “I have to say that I like it math is my favorite subject but doing Algebra is confusing and kinda hard for me.” (sic)
- 10.8, “It a bit of a challenge for myself.”
- 6.2, “It is easy they explain good & I like it.”
- 9.2, “There good. The teachers are good.”
- 5.8, “I was Really easy and this school is the best and nice school and really enjoyed my math classes.”

I tired here to roughly arrange the thought by themes, but these responses are nothing that I would not expect form a freshman.

Summary

This study looked at a total of forty-two students, four earning credit on Apex, the rest being freshman in and have earned credit in a traditional class room. The study set out to ask if there was a difference in student outcome based on method of instruction, and while the data from this study shows clearly that the traditional students did better than their peers in the credit recovery class, a mean of 7.76 verses 2.63, it would not be appropriate to draw any meaningful conclusions from it. The number of Apex student was too low to be meaningful, and the demographic data was missing to see if there was social economic trend that influences student scores.

In the student's self-reported perception of math, there were only two questions that showed any relationship between a student's response and their answer. If students reported a high engagement in learning, then those students had a higher average score on the assessment. The same is also true of the student's view of how well they learned the material, with a clear up word trend in scores as the students reported learning the material better.

Chapter V

Conclusions

This study took place at Sunnyside High School to see if there was a difference between the learning of Algebra students based on the method of their instruction. After a brief review of the purpose of this study, I will talk about the findings and limitations. Before talking about implementing a successful computer based learning program, the changes at Sunnyside High School will be discussed. The conclusion to this chapter will be about what I will take going forward from my study.

The Problem and the Action Research

As mentioned previously in this paper, Sunnyside High School is a school that has undergone a tremendous deal of transformation and growth in the last six years. Going from a failing school with low graduation rates, to a school that is exemplar among Washington State Schools. To get students to graduate means that a school needs to deal with students who are deficient in credits. A tool that Sunnyside High School employed to address this was a provider of computer based learning, called APEX.

I was interested in how this approach to instruction compared to students who were receiving their instruction in the traditional brick and mortar classroom. When gathering my research, there was a decent amount of material on computer based learning, but not great amount done at the high school level. What research there was on this topic, pointed to a mixed bag of results. If done right, this computer based learning could have similar results to that of the traditional classroom, but if bad methodology was used, instruction outcomes were not good.

The research also pointed to what methodology in computer based learning led to the best educational outcomes.

In the construction of my study, I designed an assessment that was half questions from Sunnyside Algebra Class and half from APEX which was then administered to two groups of students. The first group gaining credit in the traditional class room and the second who had earned credit by APEX.

The goal of the action research was to address the following two Research Questions:

- Is there a difference in student learning in math achievement between computer directed instruction and classroom instruction?
- What is the student's perception of academic achievement between the two settings?

Along with the assessment, students answered perception questions around their experience with the instruction of Algebra 1 and math in general. This was done to see if there was a difference in the perception attitudes of the two groups and if certain efficacy had an effect on student performances.

The Use of Computer Aid Instruction as an Educational Tool

The need for studies that look at the relationship of learning by the use of computer based instruction is a pressing concern as this technology will only increase in use in educational settings. While the details of how to implement computer based learning are specific to the method of computer based instruction, the fundamentals of this form of instruction and its relationship to education is the same as any good teaching pedagogy. Research done over the past 10 years, as well as my limited study, indicate that two aspects are important for student success. First is teacher engagement and interactions with the student's work and progress. The

second is harnessing the powers of technology to diagnosis and tailor the student's lessons to her needs. This is similar to the belief behind Sunnyside High School's transformational mantra; that with academic press, social support, and relational trust, any student, and in fact, all, students can succeed.

If done properly and with the right intention, programs like APEX can be used to fill gaps in curriculum, supplement existing instruction, offer credit recovery, and allow students to learn at their own pace. Even at its best however, it will only be on par with any existing form of good teaching. While it can meet student's differentiated needs, and present information in novel and innovative ways, it still is just instruction, and must follow the guidelines of all successful teaching throughout time in perpetuity.

The use of computer aid instruction at Sunnyside High School was not so successful, as suggested by the results of my study. The implementation of APEX for credit recovery did not fully follow the key instructional components needed for it to be highly successful. With that said, it would not take much to tweak the instruction at the high school to be much more successful at delivering instruction by APEX. In addition, this study could not draw definitive conclusions, because the sample size of students from the computer aid instruction was too small.

Since this study was done, instruction has improved in other areas at SHS to the point that the need for computer based learning has diminished and the use of APEX has decreased. At the same time, going forward, there will always be students who do not successfully gain credit in a traditional classroom the first time, so the use of this computer based instruction will not totally disappear at Sunnyside High School.

Overview of the Findings of the Study

The study ended up looking at the results of 42 students, of which only four where drawn from the students receiving credit though APEX. As will be addressed later, this is the biggest limitation of the study, in that the number of APEX students was so small. Three finding from the data are, first, students receiving brick and mortar instruction did much better on the assessment then the students who received credit from APEX. Second, when looking at perception of math and instruction, the difference between the main student body and APEX students shows no noticeable trends, and third, in only two of the perception questions was there any relationship between student scores and their attitudes in regards to the perception question asked.

The first question to show some relationship between the student scores and their answer was in regards to their engagement in instruction. Student who reported positively to how much attention they paid in class scored convincingly higher on the assessment. The other question that had a correlation between the answer and the score on the assessment was when the students were asked how well they thought they had learned the material. In this cases again, there was a positive correlation between the student scores and a positive response to the question.

Limitations to Conclusions from this Study

I talk about this in chapter four, but it is worth mentioning again. The number of students gaining Algebra credit though an alternative path used in this study was very low. It is hard to be definitive in any findings when the population size is only four students. While these four students' scores were the lowest in the assessment scores of all students, their perception responses had no noticeable trend in them to set them apart from the rest of the student

population. Another limitation to the action research was that the planed demographic data to be collected, never happened. So other factors that may account for student performances, was not analyzed.

A Brief Discussion of the Result of the Study and its Implications

Over all the students at this site who gained Algebra I credit by APEX, did not do as well as their peers in this snapshot as shown by the assessment used in the study. While the sample size was smaller than would allow any definitive statements on the matter, I will attempt to provide some reasons for this discrepancy between the two groups.

From my research and observation of the instructional environment, there were some elements of successful instruction that were lacking or not implemented with best practices to make them successful. I believe all the elements of good practice that leads to successful outcomes were present, but only in proto form and not fully fleshed out and implemented with intentionality. With only four participants who gained credit with APEX, this small sample size reduces definitiveness of the study. Given that that the small sample size impacts further recommendations and conclusions drawn from this study, here are my observations on the discrepancy between the results of the two groups of students who participated in the study.

The Apex program was not implemented as designed. Students were not required to complete components of the APEX curriculum that would have required teacher engagement, such as teacher graded assessments and modules. While the time required to grade and engage with a single student on an individual item was small, with over fifteen students per credit recovery period, this would have been a significant amount of time spent grading all the student work. At the end of the day, students were not asked to be successful on anything more than

multiple choice and true false questions; not being held responsible on more open ended questions.

This was seen as a credit recovery only and so for most of the time, there was not full buy in from the educators and students that this was to be used for instruction. Both parties saw this as a means to get a diploma and get students back on track to graduate; not as an opportunity to truly learn the material being presented. Students were interested in getting through the lesson; not focused on learning the material. As a result of this attitude, they more often used tricks or cheated to get answers on the quizzes.

A second area that led to the poor performance of students using the APEX curriculum was the monitoring of on task behavior of students. Students were not held consistently accountable to remain on task during their time in the credit recovery lab. In addition, because engagement with the students was haphazard, the students often used the internet to look up answers or retook the test enough times to memorize all the available answer choices. If there had been better engagement between teachers and students, and the monitoring of progress, I believe the students would not have fallen back upon such learned helplessness behaviors.

Accountability was internal without many outside checks. Students were allowed to retake quizzes and tests multiple times till they passed. This is not to say they were given a free pass, but intervention strategies were not used if a student repeatedly failed at the task. This is especially difficult when dealing with a student population that is lacking motivation to do well in school in the first place; a probable cause leading to poor retention of the information.

Changes at Sunnyside High School Since the Study was Done

The transformational change at Sunnyside High School has continued since my study was done. Graduation rates have continued to climb, as well as the passing rate on the state mandated test. Along with the changes within the school, new tests replacing the previous tests are now more aligned to the Common Core Curriculum.

Another change is that students no longer have the option to take Algebra as a middle school class. All students are now in the high school setting which allows staff to implement the intervention strategies if needed. And all staff teaching the course have worked together to create the standards.

When this study was done, students needing credit recovery were served totally in a semi-self-contained intervention program which was located on the grounds of SHS, but not within the main building. At that time, there were about 60 students served in this intervention program with APEX being a core component of the intervention strategy. This is no longer the case. Now, all students receive their academics within the regular classroom. Apex is still used to make up missing credit, but the numbers are down to about a third what they use to be. If a student does not pass a state mandated test, they are placed in a dedicated class to support them in being successful taking the test for a second time. These classes are within the main school building and not part of a separate special program. There is also even another level of intervention with students who have failed the state test, where they create work placed in a portfolio. They work with a subject area teacher and the portfolio is submitted to the State electronically to count for credit in place of the state mandated test.

The transformational change and progress has been marked by a school culture focused on being proactive rather than reactive to meet the needs of the students, improve graduation

rates, and meet state mandates. Sunnyside High School has become and continues to be one of the top schools in the Washington State.

Changes in graduation rates and school culture.

Last year SHS reached a 92% graduation rate, after the state waived the End of Course Biology exam as a graduation requirment for that year's seniors. Even without this waiver, Sunnyside High School would have had a 90% graduation rate. What makes this high of a graduation rate speical is that when compaired to neighboring districts, and most of the state, schools have allteritive high schools. These alternative schools' students do not count in the high school gradution rate. At Sunnyside High School there is no alteritive campus, and the high school graduation rate is the district's graduation rate. As SHS strives to imporve its graduation rates even further, the two student populations still having a gap in graduation rates that are not equal to the rest of the student body, are students with an IEP and ELL status.

In addressing the needs of these two groups as well as others, the SHS culture has continued to be proactive and unabashsively utilized the information gained from data to indentify and address areas of needed growth. The culture of the school encourages faculty intiative and creative thinking to meet chalanges. Faculty and staff are empowered to try out new ideas and potential solutions knowing that changes from the State or other entities might impact the work in progress. If things change along the way, adjustments are made to meet this new realitly.

A case that comes to mind is last school year, the State of Washigton introduced new tests mid-year without providing details prior to that time. Students were required to take both the old and the new State Mandated Tests. Even though they would be taking double the tests,

only certain tests would count toward their graduation. However, both tests would be used in the assesment of SHS. As a result of the proactive culture, SHS was able to met this challenge by modifying plans already in place. This resulted in a 96% participation from our students where other districts struggled to achieve 50% participation.

This proative cultrue even extends into the classroom, where teachers are empowered to address and propose solutions related to the data or other problems brought to them by administration and colleges. Empowerment of faculty and the proactive culture has led to the decrease in the size and nature of the interviton program. A decrease driven by lessening the need for such a program, as well as better serving students who are not on track to graduate within the traditional classroom.

Changes in the Intervention program.

In the year and a half since this study was completed, the intervention program, which was already part of the school, has been moved from the alternative class setting into the regular instructional setting. Today the only traces of it are core discipline classes for students who have failed their state mandated test either once or multiple times. The number of students who need this special setting is a third of what was served when I did my research. This is due to the overall improvement in instruction school wide.

The Future Direction of Online Education

It is clear that changes to the Sunnyside program need to be made so this new form of instruction is used to it full potential. Before looking at the local level, I want to revisit what the research says make for a successful computer aided program. The idea that keeps coming up again and again is that a blended approach of both the power of data handling brought by

computers and the personal touch of an one on one between teacher and students are the programs with the most successes.

There is no doubt that the computer and the internet will be tools in education, just like the audio visual is here to stay in schools. What form this will take is a good question. We must be careful about too optimistic titles of articles that use the terms "revolutionize" and "transform" (Waldrop, 2013) (Duncan, 2013), because education communities have heard these claims before (Muller, 2014). Just like the audiovisual was first a film strip, next a laserdisc and VHS tapes, and now streaming videos off of YouTube were projected to be the newest and best for instruction. The medium and methods change, but the core ideas behind the technology stay the same. The same can be said for this new movement of online education.

What it will look like in ten years is hard to say, but it's fair to say that it will still be with us in some form. As more studies are done, the effectiveness of the delivery gets better at meeting the stated education outcomes. Here are the things that research is saying that need to be considered as schools continue to implement computer / online learning.

Models to follow in the future.

The affective component of education that supports the emotional intelligence in creating an effective learning environment has emerged as a key component in effective online programs. Face to face works (McFarlane, January 2011). Following are some programs that have utilized face to face with on-line learning. Omaha Public Schools eLearning program uses a blended program model for credit recovery students. Students work in a lab with highly qualified teachers. Chicago Public School's VOISE Academy is a neighborhood school which follows the regular school calendar and school day with highly qualified teachers while giving students and

teachers 24-7 access APEX online curriculum. The teacher serves as an instructional guide and mentor (Watson J. , Blended Learning: The Convergence of Online and Face-to-Face Education, 2008). The LAMP Online High School uses a team of adults who are involved with the students to assure their success (Archambault & Diamond, 2010).

The role of a meaningful relationship with an adult is one component that schools need to include in their computer / online learning model. “Students who are able to create meaningful social connections that provide support from an emotional and academic level may be more likely to persist in their studies and therefore experience greater success” (Archambault & Diamond, 2010).

The role of the teacher in successful programs goes beyond the face-to-face interaction with students in blended models. Through staff development, teachers learn to understand the computer programs that the students are using. The other thing that teachers need to do for a successful program is to be directly involved in the development of the content that is used. Donovan McFarlane contends that the technology is but a tool used for instruction. The same expectation of good teaching and content that is placed on the teacher in the traditional classroom, must be expected of the teacher and the online content (McFarlane, January 2011). Teachers who have ownership of the content of the online curriculum adds to the success of the program (Quillen, 2012).

This leads to an interesting idea about how teachers are used in virtual schools using a blended model. The notion has been suggested by Ian Quillen that a business model be used in the school setting. Teachers would be paid based on their skill level. The three job levels are expert thinking and complex communication; solutions to new problems; and service jobs (Quillen, 2012). The compensation of teachers will also play a role in the acceptance by teachers

of the validity and ultimately the success of implementing a blended model in whatever program model chosen by a school (Deshmukh, Forawi, & Jaiswal, 2012) (Rauh, 2010). Thinking differently about the role the teacher plays and recognizing the significant role teachers do play in the building of relationships with student and how that ties to student success whether in the traditional brick and mortar classroom or the virtual school setting, counters the negative attitude of teachers about technology that has been reported (Quillen, 2012). Giving ownership and training teachers will be a critical aspect of the success of computer / online learning to shift to a positive perception of this tool in the education of students (Deshmukh, Forawi, & Jaiswal, 2012).

A final area that leads to the success of computer / online learning programs and models is the focus on monitoring the progress of individual students. The advantage that online learning has to the traditional classroom is that the progress of students is easily accessed through the data provided by the computer program (Watson J. F., A National Primer on K-12 Online Learning, 2007) (Duncan, 2013). This especially true when working with at-risk students. Successful programs included the individualization of plans including the amount of time of face to face as well as the content. The inclusion of a data systems that support online learning programs need to include strategies that allows teachers to monitor student progress and create individual plans (Archambault & Diamond, 2010) (Deshmukh, Forawi, & Jaiswal, 2012) (Rauh, 2010).

Policy of online learning requires that organizational structure of the virtual schools.

Whether a virtual school or a traditional brick and mortar school, a sound organizational structure and pedagogical approach are needed (McFarlane, January 2011). The goal of both of these school entities is to successfully educate the student. The structure of any organization will

determine the institutional performance and outcomes, success, and survival. This should be both planned and deliberate (McFarlane, January 2011). The movement to virtual schools and blended instruction is supported by a limited amount of research. Schools will need to have in place a structure that monitors the program and its success (Watson J. F., A National Primer on K-12 Online Learning, 2007). As schools look to the implementation and blending of face to face and online learning programs, the organizational structure that addresses the need for leadership, control, and coordination are important. This organizational structure affects decision making and that impacts morale and motivation of staff (McFarlane, January 2011).

Teaching tools can be books, whiteboards, audio visual material, or the technology of the internet. What is important about the tool is how it is used to assure that students are successful. In considering the technology of online learning, two things to consider are that there are meaningful authentic learning experiences and that teachers rethink the use of design of the face to face as they incorporate online and web-based tools into their instruction (Martine Pellerin, 2012). The tools may be different, but the pedagogical approach must make the same appropriate instructional decisions that good teaching requires (McFarlane, January 2011).

Recommendations for Sunnyside High School Use of Online Learning

With the insight gained from my research, it is clear that to have a successful online instructional program as well as any use of computer based learning, there are some essential elements needed to make the changes to the program at SHS so that all students can succeed and have educational positive outcomes.

Reconnection with the tenants of SHS

Before I give my ideas on what should happen to the use of APEX at Sunnyside High School I think it should be reminded what the mantra of SHS has as a lens on this: Academic Press, Social Support, and Relational Trust. At Sunnyside High school we believe that together we can overcome any challenge by proactively addressing situations, coming up with ways to meet them, and being held accountable to the goals that we, as staff, set. Here is how this will apply to credit recover class by online learning a SHS.

Academic Press is holding all parties, both teacher and student, accountable to true and lasting learning. The rigger must be held high, but with the understating that these students began at disadvantage starting point. Therefore there is the need for them to be supported and scaffold in their learning so they can overcome learned helpless and become successful. This was problem the root of many problems in the APEX program at the time of the study, that students did not think they could so they did not. Rigger with proper support can leas students to great learning, especially when paired with the power of computers to use data to pinpoint the area of learning the student is most in need of.

Social Support, is paramount if the students are to have successful in this setting, they must know that both the teacher in the room and the program that they are using has their best interest in mind. That it will let them grow intellectually and overcome the problems they have with both life and education. Knowing that the teacher is in the room to help the student success and will support them. These are students who have not been successful at school in the pest, so by increasing their efficacy in thinking they can do will increases their ability to overcome challenges and rough patches. A one on one approaches to each student's frustration and coaching in not what the answer is but how the student can use strategies they already know to

succeeds on their own merits is what will work best here. With less than 18 students in the credit recovery room at one time, this should easily be able to happen by a teacher actively monitoring his flock.

Relational Trust, these students are not the one who are the most highly motivated of high school students, so they need to be loved and supported with more carrots then sticks to correct behavior. They should know that the teacher in the room has there back, and their progress is celebrated. By an active role in supporting the student, then they will know that the parties involved are interested in their success and that they can recover their credit and graduate.

Training

I think that it is important for staff to be trained in the uses of this program, and the lack of this may have caused a lot of the confusion over how to use APEX. In my time in the credit recovery lab, I never once received official training in the administrating the use of the APEX program. I could tell there were areas of the program that were not being implemented.

This said, one of the ethos of Sunnyside High School is that we, the staff, are usually better off given agency over our own, classroom and be held accountable to the goals that we set. Time after time at SHS we have demonstrated that if we are allowed to come up with our own program, we can be successful in meeting the needs of students. I think this time, this is different, because this is not our own program that we are running, but administrating a third party solution.

Once the staff is fully informed on how to implement the APEX software as the vender wishes, then the staff would be better able to adapt it to the needs of our student body. This would allow a better understating on the use of the extra projects and test that were not given as

part of the program. This would also allow the staff to start to develop a common procedure on how the software was to be used at SHS.

Purpose

How the credit recovery lab was run varied from teacher to teacher, period to period, there was not consistency in how it was run and what rules and procedures were followed. It must be important that there is a shared common purpose across all times and that agreed upon ways that classes would be handled.

A common purpose for the lab and common agreed upon understanding on how the lab will be used to help students succeed. I want to point out again, that the population of students here has already failed once or twice before at the classes they are now attempting online, so it is important that the teacher build confidence in the student that they can succeed. That they provided the support need so that real and lasting learning can take place.

With these realities in mind, the ideas of SHS in mind, and a common purpose and support of the system can help students feel empowered to overcome their past failing and take this second chance to be successful and move towards graduation. It is also hoped that the students will see this as an opportunity to gain knowledge and not just a hoop to jump through on the way to graduation.

How I will go Forward, PGP

The biggest thing for me going forward that I gained from this study is the need for well thought out and designed instruction. It does not go away when using a new form of technology or any other instructional method for that matter. In my planning for lessons, it is important to

use the best practices for that form of instruction. I am now more aware that different forms of instruction require different pedagogies in order to be successful, but it is the intentionality in action that is common between setting up lessons for success.

The studies' use of data to track student's growth and asses the effectiveness of one's instruction is another tangent from this study that has changed my teaching practice. While not in the same fashion as this study, I in my daily practice as a teacher collect mounds of data on my student performance. I use this to help me both see where reinstruction is needed, but also where my instruction and assessment need to be changed. The rigor at which I do this is in part thanks to the process of going through this study.

When I do use technology in my class, and this is frequently, I remember that the blended approaches are best, and not to look on it as a miracle cure to student learning. This way I can use technologies' strength to my advantage so I can better give feedback to students to improve their performance.

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Appendices

Appendix B

Data Sources

Below is the three forms the student filled out. This was given as a packet but contained all three data collection forms.

Demographic data form, part I.

This is the only place a student's name appeared. This was used to look up that student demographic information. The second part of this form followed the perception survey.

Please fill out the following information to the best of your knowledge.

Name:
Grade Level:
Age:

Name of Legal Guardian(s):
_____
_____

Home Address:
_____
_____
_____
_____

Home Phone Number:
_____

Do not fill in this section:

Age: DOB:

Grade:

Legal Guardian:

Phone Number:

Address:

School History:
GPA:

Academic Math History:

ELL:

Special Needs:

The summative assessment.

1. Determine the value of $f(3)$when $f(x) = x^3 - 2\text{x}$

   A. $f(3) = -27$

   B. $f(3) = 21$

   C. $f(3) = 75$

   D. $f(3) = 3$

2. The function *H(x)* is described below.

   $H(x) = 3\text{x} - 4$

   What is the value of *H(6)*?

   A. 5

   B. 6

   C. 14

3. Look at the graph to the right.

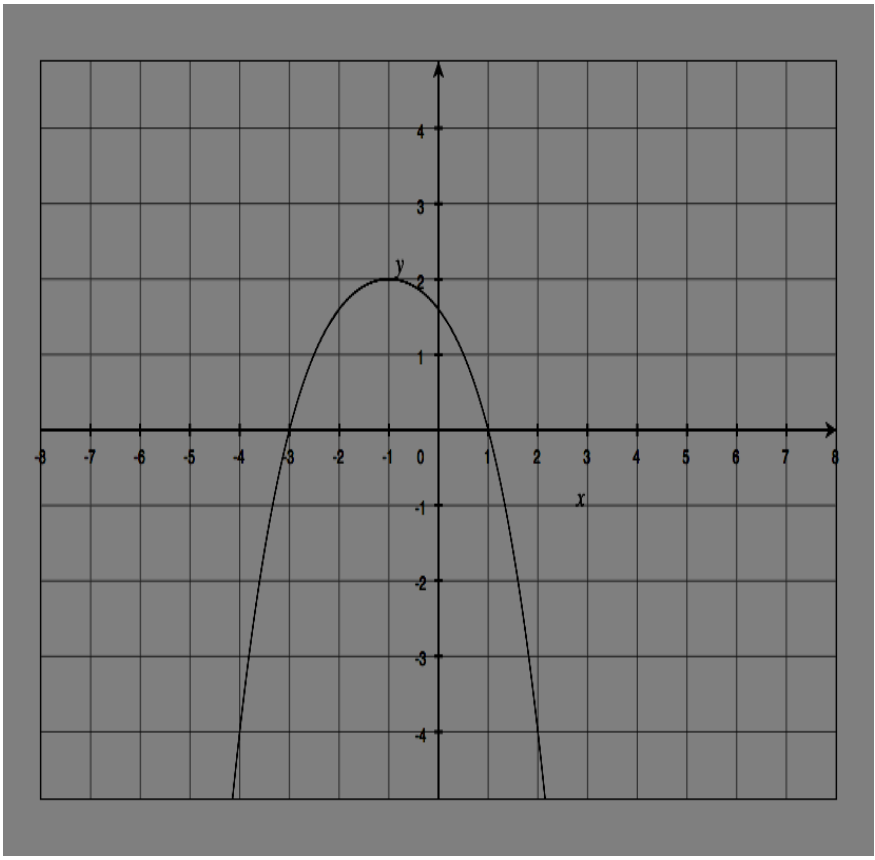
Determine the value of $c(-4)$

A. $c(-4) = -4$

B. $c(-4) = 0$

C. $c(-4) = 2$

D. $c(-4) = 4$



4. One pound is equal to 16 ounces. The function *O(p)* takes a weight in pounds (as input) and returns a weight in ounces (as output).

$$O(p) = 16\text{p}$$

If the output number is 64, what is the input number?

A. 4

B. 6

C. 48

D. 80

5. Which of the following is the solution to the equation $4\text{x} - (2\text{x} - 8) = 18$.

A. $x = 18$

B. $x = 5$

C. $x = 8$

D. $x = 13$

6. What is the solution to this equation?

$\frac{x}{-4} = 8$

A. $x = 32$

B. $x = 2$

C. $x = -2$

D. $x = -32$

7. Solve the equation $3\text{x} + 2 = 6\text{x} - 10$for x.

x = _____

8. Which number belongs to the solution set of the equation below?

$x - 4 = 17$

A. 11

B. 13

C. 21

D. 23

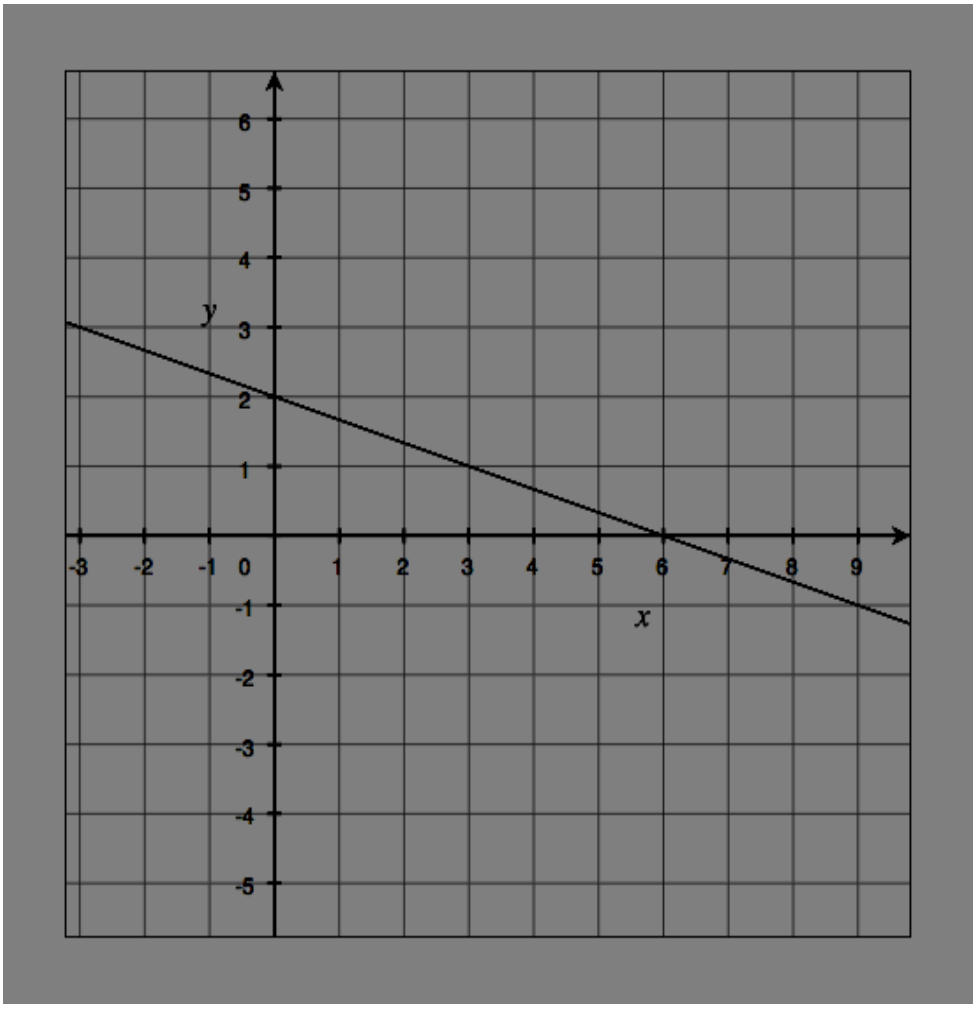
9. Determine the equations of the line graphed to the right.

A. $y = -\frac{1}{3}x + 2$

B. $y = 2x - \frac{1}{3}$

C. $y = -\frac{1}{3}x + 6$

D. $y = 3x + 2$



10. Which of the following are correct statements about the slope formula?

A. $Slope = \frac{y_1 - y_0}{x_1 - x_0}$ B. $Slope = \frac{run}{rise}$ C. $Slope = \frac{y - y_0}{x_1 - x_2}$

D. $Slope = \frac{y_1 - x_0}{y_1 - x_0}$ E. $Slope = \frac{rise}{run}$ F. $Slope = \frac{y_1 - y_0}{x_1 + x_0}$

Multiple Response: Please select all correct answers.

A. Statement A
B. Statement B
C. Statement C
D. Statement D
E. Statement E
F. Statement F

11. The scatterplot to the right has a best-fit line draw **incorrectly**.

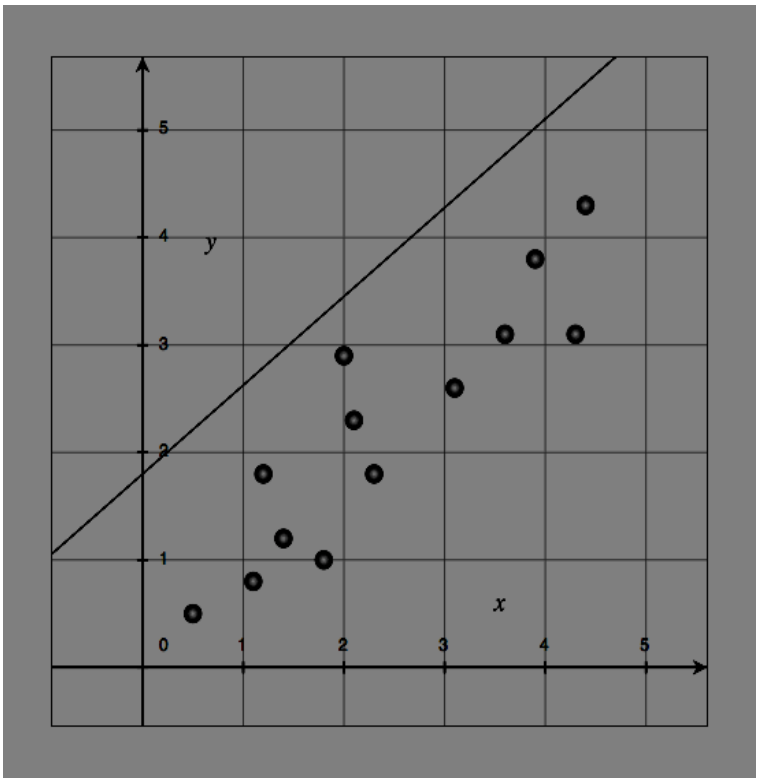
Which of the following would most appropriately fix the best-fit line?

A. Increase the slope of the line.

B. Decrease the slope of the line.

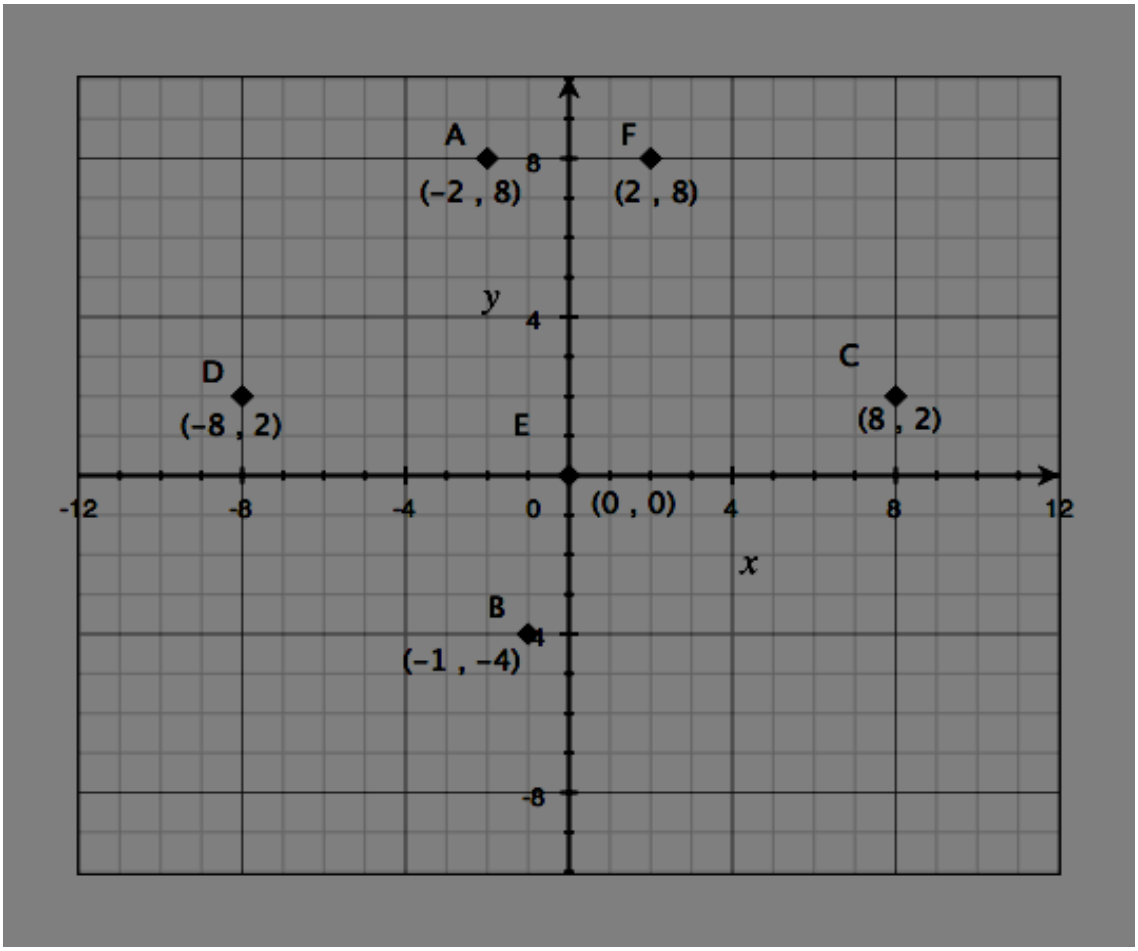
C. Increase the y-intercept.

D. Decrease the y-intercept.



12. Which of the points plotted below satisfy the equation bellow.

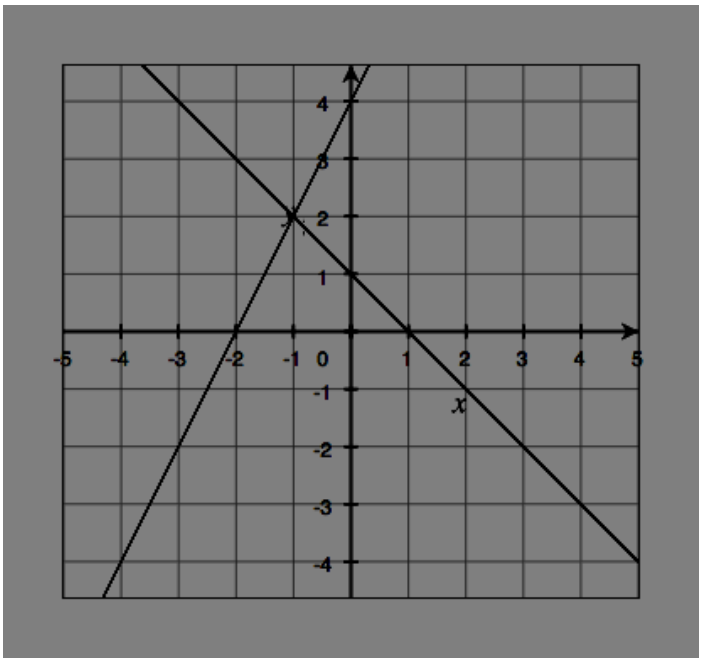
$y = 4x$



Multiple Response: Please select all correct answers.

A. Point A
B. Point B
C. Point C
D. Point D
E. Point E
F. Point F

13. A system of linear equations has been graphed and is shown on the below.



What is the y-value of the solution to this system?

y = _____

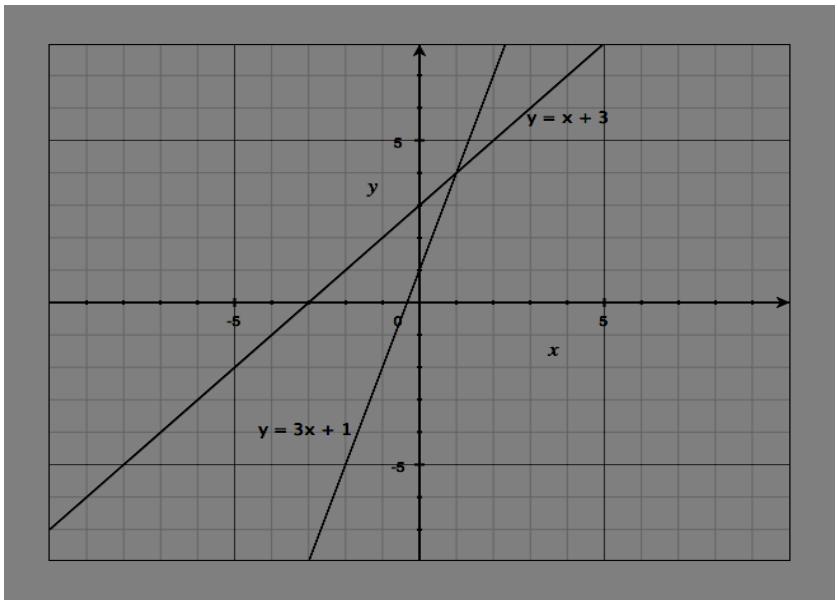
14. Determine the value of x in the solution for the system of equations shown.

$2x + 2y = 10$
$2x - 3y = 5$

x = _____

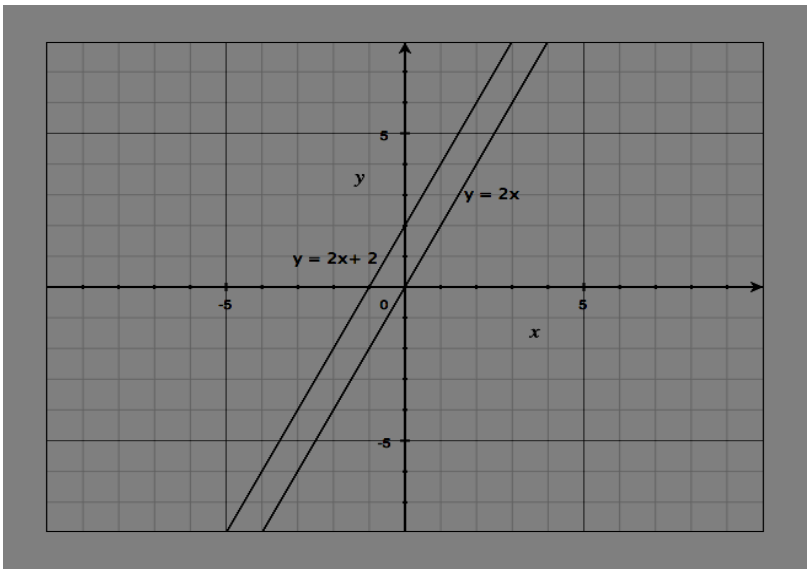
15. What is the solution to the system of equations graphed below?

$y = x + 3$
$y = 3x + 1$



A. (0, 1)
B. (0, 3)
C. (1, 3)
D. (1, 4)

16. The system of equations graphed below has how many solutions?



A. 0
B. 1
C. 2
D. Infinitely Many

The perception survey for the traditional classroom.

For each of the following questions answer based on your experience in your math class room. Each question will be ranked from a strong negative response to a strong positive response.

1. How well did you enjoy the method of instruction in your math class?
    a. Strongly did not enjoy my math class.
    b. Did not enjoy my math class.
    c. Enjoyed my math class.
    d. Strongly enjoyed my math class.
2. How engaged were you in your math class?
    a. I did not pay attention most of the time.
    b. I did not pay attention some of the time.
    c. I payed attention some of the time.
    d. I payed attention most of the time.
3. How well did you learn the curriculum taught in your math class?
    a. I learned almost nothing of what was taught.
    b. I learned about a third of what was taught.
    c. I learned about two thirds of what was taught.
    d. I learned most of what was taught.
4. How much to do you enjoy math, not just inside your math class?
    a. I strongly do not like math.
    b. I do not like math.
    c. I like math.
    d. I strongly like math.
5. How important do you think math is for academic success?
    a. Math is very unimportant for academic success.
    b. Math is unimportant for academic success.
    c. Math is important for academic success.
    d. Math is very important for academic success.

Please answer the following question to the best of you knowledge. It is perfectly ok to guess, I am more interested in what you think it is, rather than what it actually is.

1. What is your current GPA?

2. Class rank;
   a. Top 10%
   b. Top Quartile(10% - 25 %)
   c. Second Quartile (25% - 50%)
   d. Third Quartile (50% - 75%)
   e. Bottom Quartile (75% - 100%)
3. In the Space below can you list the math class have been in, the teacher name, and your grade in that class. Only fill in the grade levels you have had.

   Grade Class Teacher Grade

   Ex. 13Th Grade Math for Poets Ms. G. Bear B-

   1. 7Th Grade.
   2. 8Th Grade
   3. 9th Grade
   4. 10th Grade
   5. 11th Grade
   6. 12th Grade

4. Is there anything else you would like to say about your experience in taking math classes in Sunnyside?

The perception survey for students earning credit with APEX.

For each of the following questions answer based on your experience in using APEX.
Each question will be ranked from a strong negative response to a strong positive response.

1. How well did you enjoy the method of instruction of math on APEX?
    a. Strongly did not enjoy my math class.
    b. Did not enjoy my math class.
    c. Enjoyed my math class.
    d. Strongly enjoyed my math class.
2. How engaged were you in learning math on APEX?
    a. I did not pay attention most of the time.
    b. I did not pay attention some of the time.
    c. I payed attention some of the time.
    d. I payed attention most of the time.
3. How well did you learn the math curriculum taught on APEX?
    a. I learned almost nothing of what was taught.
    b. I learned about a third of what was taught.
    c. I learned about two thirds of what was taught.
    d. I learned most of what was taught.
4. How much to do you enjoy math, not just while using APEX?
    a. I strongly do not like math.
    b. I do not like math.
    c. I like math.
    d. I strongly like math.
5. How important do you think math is for academic success?
    a. Math is very unimportant for academic success.
    b. Math is unimportant for academic success.
    c. Math is important for academic success.
    d. Math is very important for academic success.

Please answer the following question to the best of your knowledge. It is perfectly ok to guess, I am more interested in what you think it is, rather than what it actually is.

1. What is your current GPA?

2. Class rank;
   a. Top 10%
   b. Top Quartile(10% - 25 %)
   c. Second Quartile (25% - 50%)
   d. Third Quartile (50% - 75%)
   e. Bottom Quartile (75% - 100%)
3. In the Space below can you list the math class have been in, the teacher name, and your grade in that class. Only fill in the grade levels you have had. Also fill in any APEX math class that you have taken.

   Grade Class Teacher Grade

   Ex. 13Th Grade Math for Poets Ms. G. Bear B-

   1. 7Th Grade.
   2. 8Th Grade
   3. 9th Grade
   4. 10th Grade
   5. 11th Grade
   6. 12th Grade
   7. APEX
   8. APEX
   9. APEX

4. Is there anything else you would like to say about your experience in taking math classes in Sunnyside?

Parent Consent Form

June 6, 2013

Dear Sunnyside High School Parent or Guardian:

My name is Carl Walther; I am a graduate student at Gonzaga University in Spokane, Washington. I am currently conducting research on the effectiveness of math instruction at Sunnyside High school as part of my degree. In particular I am interested in the difference between the learning of Algebra in the traditional classroom versus the use of online curriculum, APEX.

In order to conduct this study, I will be administering 18 question math assessment over content learned in Algebra 1, and a 9 question survey on the students feelings about math and math history. The math assessment and survey will take approximately 25 minutes to complete. Your child's participation in this study and in its data collection is totally voluntary.

I believe that this study is important in assessing how we are doing at Sunnyside High School in preparing our students for success as we continue to improve our graduation rate. The information from the study may help us as educators improve math assessment in the future.

If you or your child chooses to not participate, there will be no penalty. It will not affect your child's grade, treatment, or services rendered to which you or your child may be entitled. Your child's participation is on a volunteer basis and he or she may withdraw from participation at any time without suffering any ill effects. The results of this study may be published, but no participant names will be used. Your child's data collected will not be shared with any other person and will be kept confidential.

If you have any questions you can contact me at carl.walther@sunnysideschools.org, or 509.837.2601 extension 6125. Your insights and contribution are very important. It is my great hope that you will choose to allow your child to participate in this study.

Parent Consent Form

_____ **Yes**. I want my child to participate in Mr. Walther's research project. I understand that all data collection will be done during the school day. I understand that even if I check "yes" now, I can change my mind later.

_____ **No.** I do not want my child to participate in Mr. Walther's research project.

Student's First and Last Name: _____

Parent Signature: _____ Date: _____

Student Consent Form

_____ **Yes**. I want to participate in Mr. Walther's research project. I understand that all data collection will be done during the school day. I understand that even if I check "yes" now, I can change my mind later.

_____ **No.** I do not want to participate in Mr. Walther's research project.

Student Signature: _____ Date: _____

Copy of the tools / instrument to go here.