12-2017

Transforming the American Education System: A Program Evaluation of a School District's 1:1 Chromebook Pilot

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Educational Leadership Doctoral Program

Submitted in partial fulfillment

of the requirements of

Doctor of Education

National College of Education

National Louis University

December, 2017

Abstract

The focus of this program evaluation is to determine the impact of a Google Chromebook 1:1 program on the learning process and educational experience for students and teachers. The participants attend two high schools of a high-performing public-school district in an affluent Chicago suburb. The following research questions guide the program evaluation:

- What is the measurable relationship between academic performance and engagement and the 1:1 Chromebook program?
- What changes in instructional practice occur with the implementation of 1:1 Chromebooks?

A literature review presents current research in areas that explore 21st Century Skills, Tony Wagner's *Global Achievement Gap*, constructivist instructional pedagogy, and a review of school districts that have successfully implemented a 1:1 program that demonstrate student achievement growth. Participants of the program evaluation include 95 students and six teachers enrolled in English and Social Studies classes that were provided Google Chromebooks during a four-month pilot. The research includes qualitative surveys and interview data collected by the school district as part of an internal evaluation conducted at the end of the pilot. This study expands that evaluation by collecting quantitative student performance data and provides advanced statistical analysis of those data and summarizes relationships through triangulation of the findings. Recommendations include expanding the pilot to all students and more clearly defining the responsibilities of district administration and staff in supporting a 1:1 implementation.

Preface

The aspects of the program evaluation that had the greatest impact on my leadership were the review of literature, the statistical analysis using SPSS, and the subsequent leadership conversations that followed with the Superintendent, the Board of Education, and fellow district administrators. The process of the literature review expanded my curriculum background through the readings of Tony Wagner and Michael Fullan, and challenged my thinking around the role of technology in learning. Wagner's writings challenged me to think on a larger scale, to explore the changing dynamics of the marketplace and the skills required for students to be competitive in the labor force. Fullan caused me to reflect upon instructional pedagogy and the active role of teachers in technology integrated classrooms.

The process of collecting data, creating hypotheses about relationships based on those data, and then using statistical software with SPSS, was an entirely new aspect of learning. The time spent with Dr. Elizabeth Minor in understanding the results and additional statistical analyses I needed to conduct also was extremely valuable and informed the findings and recommendations.

Finally, the program evaluation provided me a research base and background knowledge to speak as an expert. Conversations with the Superintendent, Board of Education members, district administrators, and several other stakeholders regarding the role and impact of instructional technology now have depth and breadth. The process has informed my thinking and future responsibilities for successfully leading a 1:1 initiative for this school district.

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SECTION ONE: INTRODUCTION

Purpose

School District "A" is secondary district comprised of two high schools in a predominantly suburban county in Illinois. As the Director of Technology for District A, I have direct responsibility, with the Director of Curriculum, for integration of technology for the improvement of instruction and student learning. When I started working for District A in June 2011, district leadership met with student and teacher leaders and identified that technology-rich learning experiences in classrooms were necessary to meet the mission of developing students' innovative problem-solving skills. To meet this goal, the District A Board of Education committed two million dollars for technology infrastructure improvements. After two years of major technology infrastructure upgrades, including ubiquitous wireless access and reliable, robust internet access, District A was ready to take the next step.

By the start of the 2013-14 school year, several area high school districts had already launched student technology initiatives, purchasing a laptop, tablet, or Chromebook computing device for every student. District administration at District A did not follow suit, but instead decided to thoughtfully pilot different devices to determine which device best met the teaching and learning needs for the community's students. In 2013-14, the district determined that they would evaluate three different instructional technology pilots. The first pilot implemented Apple iPads and these devices were used exclusively in Science and World Language classrooms. The second pilot used Google Chromebook carts and teachers in all content areas signed up to use the devices in their

classrooms. The third pilot allowed students to bring their own personal technology: phone, tablet, laptop, etc. and called this pilot Bring Your Own Technology (BYOT).

District A spent one school year integrating each option instructionally, and solicited feedback from students, teachers, and administration through surveys. Upon completion of the 2013-14 school year the District administration desired feedback on the aforementioned technology pilots of iPads, Chromebooks and Bring Your Own Technology. The district collected quantitative survey data from students and teachers and qualitative small group interviews from the 2013-14 school year. Chromebooks received the highest positive responses in both qualitative and quantitative measures. Assessment data improvements were not considered since multiple technologies overlapped, thus isolating the impact of one technology from another was not feasible.

The District analysis of qualitative and quantitative data led to the recommendation of the expansion of the Google Chromebook platform and exploration of steps necessary to consider student assignment of Chromebooks in a 1:1 setting. District A expanded the number of Chromebook carts available for teachers, but also decided to conduct a new pilot in which one hundred students, split between the two schools, would have a Chromebook assigned to them for school and home use.

District A had numerous goals for this pilot. First and foremost, the goal was to measure impact on student performance, specifically in the areas of writing and research. Students participating in the study were enrolled in English and Social Studies, courses which emphasized these specific content skills. The District also wanted to evaluate the impact on the student learning environment to determine if the devices offered measurable impact in areas of personal organization, collaboration, and communication

between students and teachers, etc. As technology integration and statistical significance on teaching and learning is likely in the infancy stage, the district determined that qualitative "user" feedback would be relevant. Ultimately, the District wanted to know if a 1:1 technology initiative could demonstrate measurable impact, thereby warranting the changes required for broader implementation to all students. Evaluation findings might provide evidence indicating measurable student learning impact from qualitative or quantitative data sources, informing the expansion of this pilot for additional students.

Wishing to move forward toward the mission of increasing student innovation and problem solving skills, the District A leadership proposed and the Board of Education approved a $50,000 pilot of Google Chromebooks in a 1:1 pilot in the fall of 2014. In collaboration with building leadership teams, the district selected one-hundred students between High School C and High School N to participate. Teachers selected worked in co-teacher settings in English and Social Studies courses. Teachers were also identified as potential pilot classes if they taught general education and special education students enrolled in non-honors classes, and these teachers were required to have prior successful teacher evaluations. The pilot provided the device to students at the end of the first semester, December 15, 2014 with the objective of student acclimation to the technology and set up for home technology network use. Students would have access to the device throughout the second semester courses with the same teacher and could use the device in other courses, during non-instructional periods, and at home.

The district also realized that a device in the hands of every student would dramatically change the teaching landscape; the administration valued the feedback that teachers could provide on instructional design, paradigm shifts towards constructivist

teaching, classroom management, student preparedness in a technology-centric classroom, and the assessment of learning. This program evaluation would also serve the purpose of "knowledge generation" (Patton, 2008, p. 141), assisting district and building leaders to identify changes necessary in professional development, curricular implementation, and facility use should a larger implementation be pursued. Key components of a successful technology initiative are reliability, performance, and sustainability. Through this pilot, the district wanted to experience the effects of a "rollout," to understand the logistics of acquisition, distribution, documentation, etc**.** The district leadership team held several discussions in the planning of this pilot and identified factors to monitor throughout the pilot. The factors included the hardware reliability of the device, the need for additional staffing, the most successful methods of teacher professional development, and level of responsibility demonstrated by students and families for the device.

This study is a program evaluation of the 1:1 pilot of Google Chromebooks. Patton characterizes six primary uses of evaluation findings and judgmental use provides an overall summative evaluation, described as the "ultimate purpose of evaluation" (Patton, 2008, p. 137). This program evaluation planned to provide the summative judgement of the Chromebook 1:1 pilot through a review of the program implementation, the relevant literature, and the data collected by District A.

Rationale

The program evaluation of the 1:1 pilot provides relevancy for the district and building administration, Board of Education, community stakeholders, students, teachers, and families. As the Director of Technology, I am responsible for all instructional

integrations with technology tools. Conducting a thorough program evaluation is an expectation as a cabinet level administrator. I am expected to have expertise in both technical performance and instructional integration and am responsible for educating and advising stakeholders, as well as the greater educational community, on technology initiatives, specifically this technology pilot. I have worked in district leadership for eight years, four years with District A. I believe wholeheartedly that information literacy and 21st Century skills of innovation, collaboration, communication and problem solving are critical to individual success, and required for students to be competitive in the global marketplace (Wagner, 2010). I accept the responsibility of preparing District A students for global success and feel strongly that technology tools such as Chromebooks, partnered with quality teachers implementing challenging learning experiences, offer greater opportunities to develop these skills than without technology tools.

District A conducted surveys and interviews at the end of the 2014-15 school year about 1:1 Chromebook pilot. The Director of Curriculum, the Associate Superintendent for Human Resources and Curriculum/Instruction, and I analyzed the data collected. We completed an executive summary and shared this data with the Superintendent and leadership team and with the Board of Education and teacher leaders in February 2016. This program evaluation expands the District research originally performed at the end of the 2013-14 school year. This program evaluation reviews relevant literature, collects additional student performance data and utilizes existing 2013-14 data, analyzing data trends and triangulate findings, ultimately providing recommendations that inform the district administration, Board of Education, and community members.

Goals

The primary goal of the program evaluation was to determine the impact on the learning process and educational experience for students and teachers involved in the Google Chromebook in a 1:1 model in the District A pilot. District A wanted to determine if students involved in this pilot demonstrated skill improvements, increased engagement with the learning process, and to evaluate the effects on instructional practices. Students enrolled in these courses would be characterized by average academic performance, seen as struggling learners, and sometimes disengaged with school. The summative judgment the district hoped to accomplish through the pilot and evaluation was the determination of the efficacy of a 1:1 student computing model and if student access to technology demonstrated any measurable statistical differences that could support the expansion of the pilot to more students throughout the district.

Research Questions

The primary research question for evaluation of this pilot is, “What is the measurable relationship between academic performance and engagement and the 1:1 Chromebook program?” This question has been discussed frequently during district cabinet meetings, as the leadership team wanted to measure if any correlation could be directly associated between the technology device and student academic performance and instructional engagement. A second, related question is, “What changes in instructional practices occur with the implementation of 1:1 Chromebooks?” Students having a technology tool for learning anytime, anywhere, may impact teaching and learning, and District A wanted to generate knowledge around a 1:1 implementation and develop internal teacher experts should an expansion occur.

SECTION TWO: REVIEW OF THE LITERATURE

To ensure the success of the Chromebook 1:1 pilot at District A, in High School C and High School N, I needed to identify the current research and best practices for integrating educational technology and thereby improve student learning. This literature review will examine three topics related to this goal. The first topic will explore 21st Century skills, how these skills affect workers in the competitive global marketplace, and the need for transformation of the traditional American education system. The second topic will examine constructivist instructional design and how technology affects and supports this pedagogical model. Research suggests that students learn best when in a constructivist student-centered learning environment. Instructional technology is often implemented in today's schools through 1:1 device assignment, so the third aspect of the literature review will examine other school districts that have implemented a 1:1 program and the impact upon student achievement.

21st Century Skills, the Global Achievement Gap, and Transforming the American Education System

Most American schools continue to structure teaching schedules, assessments, and content delivery the same as they did throughout the 20th century. This structure of 40 to 50 minute "periods" has "pigeonholed learning" (Chen, 2010, p. 144). U.S. schools are, "captives of the clock and calendar" (Chen, 2010, p. 143), and then arbitrary divisions, "reinforce divisions between subjects" and lead to teachers working in "isolation" (Chen, 2010, p. 144). The academic model common in traditional classroom instruction reflects a teacher-centric model, with the teacher teaching their content, the

student listening, and then students completing an assessment to demonstrate mastery of learning.

Educators should not find it surprising that research reports the U.S. education system focuses on low-level knowledge retention and not higher order skills and applications of learning (Dintersmith & Wagner, 2015, p. 42). Chen quotes Dr. Allen Glenn from the University of Washington, "We all think we know what a school is and how a classroom is organized, since we spent eighteen years in them during our formative years" (Glenn, quoted in Chen, 2010, p. 11). Educators have a model they follow, and the, "biggest obstacle to school change is our memories" (Chen, 2010, p. 11). Dintersmith and Wagner report that most American schools are focused on lecture based models, and that these types of courses, "contribute almost nothing to real learning" (Dintersmith and Wagner, 2015, p. 7). They add that, "U.S. Education is largely a hollow process of temporarily retaining the information required to get acceptable grades on tests" (Dintersmith & Wagner, 2015, p. 42). Michael Fullan adds that students report that they are, "increasingly bored in school and evermore as they go from grade to grade" (Fullan, 2013, p. 23).

U.S. education has evolved into a school model where "academic success" is driven by standardized tests such as PARCC, Smart-Balanced, ACT, Advanced Placement, Stanford Achievement Test, Measure Academic Progress (MAP), The Iowa Test of Basic Skills, STAR, TerraNova, and the WorkKeys to name a few! States such as Illinois developed a teacher evaluation system, Illinois Senate Bill 7 (Illinois State Board of Education, 2017), requiring growth models and recommending assessments such as

those mentioned. Despite the considerable time spent on these tests, the results are not leading to success in our colleges or in the global marketplace.

In Wagner's *Global Achievement Gap* (2010), he states that only, "one-third of high school students graduate prepared for college" and that "sixty-five percent of college professors report that what is taught in high school does not prepare students for college" (Wagner, 2010, p. xix). Wagner adds that the U.S high school graduation rate is about seventy percent, well behind European and Asian counterparts. Of those students successfully completing college, Wagner recently mentioned in a "Ted Talk" that fifty-four percent of college graduates could not find a job in the global economy (Wagner, 2012). In Wagner's book, *The Global Achievement Gap* (2010) he put it simply, "Schools haven't changed; the world has…and our schools are obsolete" (Wagner, 2010, p. xxi). Schools "…were never designed to teach *all* students how to think" (Wagner, 2010, p. xxiii), and this is seen in the lack of intellectual challenge found in most classrooms.

Wagner identifies that, "*all students need new skills* for college, careers, and citizenship" (Wagner, 2010, p. xxi). The global economy has transformed from one where most people worked "with their hands" to one where they work with "their heads" (Wagner, 2010, p. xxiv). The "new competition is in innovation and invention, creativity, productivity, and vision" (Greaves, Hayes, Wilson, Gielniak & Peterson, 2012, p. xvi). Knowledge is readily available on the internet, in video, and no longer is the teacher required to be the traditional disseminator. Dintersmith and Wagner (2015) said it best that, "What matters most in our increasingly innovation-driven economy is not what you know but what you can do with what you know" (p. 27). "Americans can no longer rest

assured that our long run of productivity, prosperity, and preeminence will continue unabated or unchallenged" (Vockley, 2007, p. 2).

The skills identified for college and career success are identified by both Tony Wagner's *Global Achievement Gap* and The Partnership for 21st Century Learning "P21." Wagner identifies seven "Survival Skills" critical to remaining competitive and prosperous. Wagner references these skills throughout chapter one and they are:

- Critical thinking and problem solving
- Collaboration across networks and leading by influence
- Agility and adaptability
- Initiative and entrepreneurialism
- Effective oral and written communication
- Accessing and analyzing information
- Curiosity and imagination. (Wagner, 2010, chapter one)

P21 identifies similar threads as Wagner, classifying *Learning and Innovation Skills* that include creativity, innovation, critical thinking and problem solving, communication, and collaboration. P21 also emphasizes the need for *Information, Media, and Technology Skills*, as, "citizens and workers must be able to create, evaluate, and effectively utilize information, media, and technology" ("Framework for 21st Century Skills," 2015). P21 maintains the need for content knowledge of core subjects and fine arts, but also echoes Wagner in the need for Life and Career Skills that include flexibility and adaptability; taking initiative and being self-directed; personal productivity and accountability; and leadership and responsibility. Schools can no longer send out students with just information, they must have these types of skills modeled for them and practiced in everyday learning experiences. Greaves, Hayes, Wilson, Gielniak & Peterson (2012), in *Project RED*, note a profound statement by colleague Seymour Pape, "It is no longer good enough for schools to send out students who know how to do what they were

taught. The modern world needs citizens who can do what they were not taught. We call this *learning learning*" (Greaves, et al., p. xvi, 2012). The authors understand that successful students must have the ability to step back, be metacognitive, see patterns and trends, and apply knowledge and skills to bring personal success. Students must have the ability to recognize a problem and determine what skills and tools to implement. Traditional teacher-centered classrooms do not foster this type of student learning, hence the movement towards constructivist learning supported with technology.

Constructivist Instructional Design

Traditional American education classrooms have not changed in the past 100 years. High school classrooms have typically 25-30 students scheduled in 45 or 50-minute class periods in desks in rows and one teacher designated per content area. Students select the courses and continue year by year accomplishing goals outlined in the state graduation requirements. Individual classrooms may have some modification in furniture design to support student collaboration, but instructional design is historically more teacher-centered than student-centered (Dintersmith & Wagner, p. 7). Dintersmith and Wagner point out that, "most lecture-based courses contribute almost nothing to real learning" (p. 7). Hence the increased boredom and reduced student engagement reported by Fullan (2013, p. 23).

What is necessary is a transformation of the educational design of learning, one where students play an active role in all aspects of the learning process. Fullan describes this model as a "new pedagogy" where "teachers and students (work) as learning partners" (Fullan, 2013b, p. 5). This teaching model is based on the premise that, "consequential and retained learning comes…from applying knowledge to new situations

or problems, research on questions and issues that students consider important, peer interactions, activities, and projects" (Dintersmith & Wagner, 2015, pp. 7-8). Instead of asking students to memorize and reiterate information, educators should be asking students, "what can you create with the information you've found?" (Chen, p. xii) Chen adds that, "students learn more deeply when they can apply classroom-gathered knowledge to real-world problems, and when they take part in projects that require sustained engagement and collaboration" (p. 37). Solvie and Kloek (2007) support this instructional design concept where teachers/students are, "viewing learning as a process and not a product, developing inquiry skills, acquiring knowledge, as opposed to memorizing, and applying knowledge and skills in the context of relevant settings [that] reflect experiential learning" (Solvie and Kloek, 2007, p. 9).

Michael Fullan, considered one of the experts on education reform and constructivist learning, explains that the "New Pedagogy" in classrooms must meet four criteria if the boredom and disengagement trends in classrooms are to change. The criteria of the New Pedagogy are engaging for both students and teachers; elegantly efficient and easy to access and use; technologically ubiquitous 24/7; and steeped in real-life problem solving (2013b, p. 8). Fullan adds that this type of learning pursues, "deep learning goals," which he refers to as the "6 C's: critical thinking and problem solving; communication; collaboration, creative thinking and imagination; character education; and citizenship" (2013b, p. 8). These goals are quite similar to Wagner's *Seven Survival Skills* and the International Society for Technology and Education's (ISTE) *Standards for Students* (2007). In the constructivist learning environment, the teacher's role is to achieve these skills and standards by facilitating and guiding the knowledge construction

process (Paily, 2013, p. 40). Paily adds that constructivist teachers, "design and provide learning activities and experiences characterized by collaboration, cooperation, multiple perspectives, real-world examples, scaffolding, self-reflection, multiple representations of ideas, and social negotiation" (p. 40).

Fullan's latest research and speaking engagements take the constructivist notion of the teacher's role as a facilitator and recommends the "Teacher as Activator" (2013, p. 25). Using a meta-analysis of over 1000 research studies by John Hattie (2012), Fullan notes that instructional practices characterized as teacher as facilitator has an effect size of .17 on student learning, whereas instructional practices with the teacher as activator has an overall effect size of .60 (Fullan, 2013, p. 25). In *Visible Learning*, John Hattie (2012) identities 138 influences that impact student achievement, with the average effect size of .40. The role of teacher as facilitator is below the average and the role of activator significantly above the average. The differentiation of the two instructional practices is evident in the participatory role of the teacher. Teacher as facilitator is characterized by Fullan as, "inquiry based; simulations and games; smaller class sizes; individualized instruction; problem-based learning; web-based; and inductive teaching" (Fullan, 2013, p. 25). Teacher as activator is described with these pedagogical factors: "reciprocal teaching; feedback; teacher-student self-verbalization; meta-cognition; goals challenging; and frequent checks on effects of teaching" (Fullan, 2013, p. 25). "Teacher as activator" instructional lessons require students to be engaged in active learning practices which, "have a more significant impact on student performance than any other variable, including student background and prior achievement" (Chen, 2010, p. 37). Students in

these types of learning environments are taught, “How to learn and what to learn” (Chen, 2010, p. 37), which often leads to personal success.

The research of Rosen and Salomon (2007) support constructivist teaching methods as more effective than traditional designs. In their research on mathematics instruction, these authors found that, “constructivist technology-intensive learning environments (CTILE), had an effect size (ES) of .902 versus traditional methods with an effect size of .460” (Rosen & Salomon, 2007, p. 1). The ES indicates that students in classes using constructivist technology-intensive learning environments outperformed their counterparts. Students in CTILE environments were “actively engaged in problem-solving teams” using self-guided activities that required higher order thinking skills and “participatory teamwork through active exploration, problem solving, and critical thinking” (Rosen & Salomon, 2007, p. 3). Rosen and Salomon found that traditional teaching methods were best suited for, “transmission of knowledge from teacher to student” (Rosen & Salomon, 2007, p. 3). Technology tools provide students, “access to rich sources of authentic information, encourages meaningful interactions with content, and brings people together to challenge, support, and respond to each other” (Paily, 2013, pp. 40-41). Paily adds that new technologies, “foster cooperation and construct human networks that promote sociability through knowledge and mutual participation” (p. 44). The, “explosion of the digital world,” (Fullan, 2013, p. 24) has created an environment where classrooms supporting constructivist methodology can utilize technology tools working towards goals identified by Tony Wagner, The Partnership for 21st Century Skills, the International Society for Technology in Education’s National Educational Technology Standards for Students, and Michael Fullan.

The first U.S. Governor to embrace the vision of constructivist teaching and the role of instructional technology was Angus King. Mr. King served as the Governor of Maine from 1995 – 2003, and he believed so strongly in technology's role in student learning that he pushed forward legislation where Maine became the first 1:1 student mobile device state. Angus King provided the foreword to Project RED, a benchmark of research regarding instructional technology impact on student learning. King remembers the impact embedded technology had in developing constructivist teaching, noting that he, "realized about the second year in that it [technology with every student] was really a radical idea because of the changes to pedagogy and changes to education. It was a different kind of teaching and learning" (Greaves, et al., 2012, p. 92). King understood the importance of giving students the responsibility for their knowledge building, "giving them the tools and techniques to teach themselves, in both school and beyond…the modern world needs citizens who can do what they were not taught" (Greaves, et al., 2012, p. xvi).

Technology provides opportunities for "learning by doing" or "learning by seeing experiences" (Solvie & Kloek, p. 10), defeating the disengagement and boredom of teacher-centered instruction. When classroom instruction continues down a path of class after class and year after year of traditional instruction, "children's beliefs become their mental baggage that they bring to achievement [and performance]" (Blackwell, Trzesniewski & Dweck, 2007, p. 29). Boredom and disengagement is a demonstration of that mental baggage. Technology can transform the classroom in a, "truly student-centered learning experience… [Where] constructivist pedagogy practices increased exponentially" (Greaves, et al, p. 26). Our goal as educational leaders should be to

leverage student engagement, as the motivational benefit to every students' intellectual capacity is increased in constructivist teaching environments (Blackwell, et al., p. 29).

1:1 Technology and Student Achievement

There has been a dramatic shift over the past ten years in the role technology plays for people in personal and professional circles, in social networking, in data acquisition and analysis, in anytime-anywhere knowledge, in economics, politics, and even in the field of education. Student achievement has been successful in the United States and around the world before the advent of technology, yet now technology is providing a valuable tool accessible for teacher and students. Doubters still exist, thinking that technology does not have a place in schools, offering many counterarguments such as "it's expensive; technology doesn't always work; and teachers don't know how to use them" (Chen, 2010, p. 87). Chen also poses the following questions to those doubters: "Do you use a computer? Would you give up your computer? Would you share your computer with three other people" (p. 87)? We all use computers in our professional lives and our answers to questions two and three is likely that we would not give up access or want to share. Schools have the same responsibility to provide students tools without the need to share as adults in their professional careers do, if the expectation is to be globally competitive.

The research provided in the past sections identify the changing global economy, and skills necessary for students to be competitive in the 21st century marketplace. The research also highlights the transformation of technology-rich classrooms that adopt constructivist teaching models. These types of classrooms engage students, allowing students to be active and participatory in the thinking and learning process. Educators

want students to "know how to find information, how to assess the quality of information, and how to creatively and effectively use information to accomplish a goal" (Chen, 2010, p. xi). This "curricular structure…harnesses student engagement, leads students to learn in deeper and more meaningful ways, and allows students choice in what and how they study" (Chen, 2010, p. 41). Chen feels so strongly about technology and its impact on learning that he states, "None of our hopes for education – for closing the achievement gap, for getting all students to college, for educating a modern workforce of teachers – will be realized until every student, teacher, and administrator has a computer and access to the Internet. One-to-one access is now the digital civil right of every student…" (2010, p. 88).

While Chen feels that this is a digital civil right, increased academic performance is not an automatic result just because a student is assigned a computer. *Project RED* identifies organization leadership as a key to academic success with 1:1 technology implementations. The authors state, "Ultimately, the implementation of best practices is as important as the technology itself, and the value of technology in terms of student achievement depends on the quality of the implementation itself" (Greaves, et al., 2012, p. 10). *Project RED* notes, "We have all learned that it is all about the teachers and the leadership in the school; with great professional development and a new pedagogy, amazing things happen, but just handing out laptops is not going to do it" (Greaves, et al., 2012, p. xvii). This effectiveness must be at multiple levels: Board of Education; Superintendent, District Leadership, Technology, Finance, and Operations. The most critical aspect contributing to increased student performance is principal leadership.

So as technology tools enter classrooms, "the right curriculum and skilled teachers are still the key" (Chen, 2010, p. 67) and the building principal must develop these teacher skills. Greaves, et al., note that the principal is, "the primary influence of professional development with a school" (2012, p. 14). The authors add that, "The quality of a principal's leadership has a major impact on technology usage, leading directly to student outcomes" (p. 14). *Project RED* identifies these critical measures of an effective principal in terms of student technology use:

> Skillful change leadership, conceptual and tactical understanding; Real system reform versus tinkering around the edges; Communication about best practices; A shared and inspiriting vision; Stakeholder buy-in; Consistent, open communication with and among stakeholders; and Planning for technology acquisition, implementation, and assessment. (Greaves, et al., 2012, p. 14)

Project RED is a national report compiled by several researchers on behalf of the International Society for Technology in Education. The goal of the *Project RED* report was to analyze what is "working" in technology-transformed schools, and to show how districts can reform education, increase student performance, and save money. Their research encompassed over 1,000 schools looking at factors that contributed to the success or failure of technology integration in their schools. The research looks at several characteristics in determining their findings. *Project RED* identified "Key Implementation Factors" which differentiate schools properly implementing technology versus those that do not. The Key Factors are:

> Intervention classes (targeted technology use); Change management leadership by principal; Online collaboration; Core subject (students using technology daily into core curriculum); Online formative assessments; Student-computer ratio; Virtual field trips; Search engines (students use daily); and Principal training (trained to lead effective implementations). (Greaves, et al., 2012, p. 23)

The *Project* RED report correlates eleven "Educational Success Measures (ESMs)" (Greaves, et al., 2012 p. 21) that they believe provided specific variables which reflect the effects of successful implementations. The ESMs were categorized into those that affect all grades, and those affecting high school only. The reporting ESMs are:

All Grades

- Disciplinary Action Rate
- Dropout Rate
- High-Stakes Test Scores
- Paper and Copying Expenses
- Paperwork Reduction
- Teacher Attendance

High School Grades

- AP Course Enrollment
- College Attendance Plans
- Course Completion Rates
- Dual/Joint Enrollment in College
- Graduation Rates (Greaves, et al., 2012, p. 3)

Project RED concluded that schools with a 1:1 computer ratio that practiced the top four implementation factors [intervention, change management, collaboration, and core subjects] saw the greatest gains in Educational Success Measures (Greaves, et al, p. 13). Looking at all schools that met these criteria, survey results reflecting the following growth regarding ESMs (Greaves, et al, 2012, p. 15):

- 92% report disciplinary action reduction
- 90% report high-stakes test score increase
- 89% report dropout rate reduction
- 63% report graduation rate increase

Schools that reported that they did not properly implement 1:1 technology well still experienced positive results, but not to the extent of the prior group (Greaves, et al., p. 13):

- 65% report disciplinary action reduction
- 70% report high-stakes test score increase
- 58% report dropout rate reduction
- 58% report graduation rate increase

Finally, schools without 1:1 technology but with regular access do benefit from their limited access. These schools reported (Greaves, et al., 2012, p. 14):

- 50% report disciplinary action reduction
- 69% report high-stakes test score increase
- 45% report dropout rate reduction
- 51% report graduation rate increase

Several school districts validate that 1:1 technology implemented successfully can have an impact on student achievement. The first of these school district is Klein Independent School District near Houston, Texas. Klein ISD is a diverse school district of 46,000 students and 6,000 teachers. Students are White (38.7%), Hispanic (35.9%), African-American (13.8%), and Asian (8.3%). The district has over 40% of their students classified as economically disadvantaged. Klein ISD used the Texas state assessment TAKS to analyze the impact of 1:1 technology before and after the initiative. Looking at test scores at two high schools, Klein Oak and Klein Forest, identify measurable academic gains in core subject areas as identified in Table 1.

Table 1 – Klein ISD Accountability Data Table – All Students

Tracking TAKS Data Before and After 1-to-1 Program Initiation: All Students

	Klein Oak High School					Klein Forest High School			
	Students who met the standards (%)				Point gain (%)	Students who met the standards (%)			Point gain (%)
	Before 1-to-1	1st Year	2nd Year	3rd Year	Cumulative	Before 1-to-1	1st Year	2nd Year	Cumulative
Reading/ELA	90	92	94	93	3	85	89	87	2
Math	76	81	84	82	6	60	67	69	9
Science	78	86	90	91	13	69	79	81	12
Social Studies	92	95	97	98	6	91	93	95	4

Data Sources: TEA, KOHS AEIS Report, KFHS Campus Accountability Data Table, KFHS AEIS Report, KFHS Campus Accountability Data Table

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Klein ISD also evaluated the gains for economically disadvantaged students [Table 2] and notes the "student gains immediately after the implementation of the 1:1 tablet PC program" (Greaves, et al., 2012, p. 38).

Table 2 - Klein ISD Accountability Data Table – Economically Disadvantaged Students

Tracking TAKS Data Before and After 1-to-1 Program Initiation: Economically Disadvantaged Students

	Klein Oak High School					Klein Forest High School			
	Students who met the standards (%)				Point gain (%)	Students who met the standards (%)			Point gain (%)
	Before 1-to-1	1st Year	2nd Year	3rd Year	Cumulative	Before 1-to-1	1st Year	2nd Year	Cumulative
Reading/ELA	78	82	90	89	11	83	87	85	2
Math	59	65	73	69	10	57	64	68	11
Science	58	71	81	82	24	65	76	79	14
Social Studies	81	88	92	95	14	89	92	94	5

Data Sources: TEA, KOHS AEIS Report, KFHS Campus Accountability Data Table, KFHS AEIS Report, KFHS Campus Accountability Data Table

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As leaders of Klein ISD reflected on the results, the felt that, "the goals of embracing the future and engaging students in their learning are being met" (Greaves, et al., p. 39).

Mooresville Graded School District (MGSD) in Mooresville, North Carolina is another showcase example of the impact 1:1 technology can have on student achievement. MGSD is comprised of eight schools and 5,400 students. Students are White (73%), African-American (15%), Hispanic (7%), Multiracial (3%), and Asian (2%). The district is 39% economically disadvantaged. MGSD was one of the first school districts in the United Stated to embrace a 1:1 initiative, providing technology to every student in grades 3-12 in 2007. Dr. Mark Edwards, MGSD Superintendent, reports that, "technology has played a significant part in improving teaching and learning though increased student engagement in Mooresville classrooms. Laptop computers have significantly enhanced the level of student interest, motivation, and engagement to learn" (Greaves, et al., 2012, p. 44). Edwards states that, "We knew our Digital Conversion project was the right move for students, teachers, and the community based on the need to create a relevant experience in our schools that will prepare students for their future" (Greaves, et al., 2012, p. 44).

The Mooresville academic results on the North Carolina State Performance and Academic Composite data support that this was the correct decision. *Project RED* reports that in 2009-10, MGSD was only one of six school districts in the state to make

Adequately Yearly Progress (AYP) according to No Child Left Behind (NCLB) requirements. MGSD also had the "highest number of targets met" (Greaves, et al., 2012, p. 44). Table 3 identifies the continued student growth, with student proficiency on the North Carolina State Assessment growing to 88% proficient or better in 2010-11. This academic growth and expansion of technology occurred MGSD being one of the lowest funded per-pupil expenditures in the state at around 100 of 115 districts.

Table 3 - Mooresville, North Carolina State Performance Table – All Students

North Carolina State Performance and Academic Composite Data

Year	Mooresville Graded School District (% of students graded proficient or higher)
2007–08	73%
2008–09	82% (ranked eighth in state)
2009–10	86% (tied for fourth in state while ranked 101 out of 115 in per-pupil expenditures)
2010–11	88% (tied for third in state while ranked 99 out of 115 in per-pupil expenditures)

Source: Mooresville School District

Note. From Revolutionizing education through technology: The project RED roadmap for transformation (p. 44) by Greaves, T., 2012, Eugene: OR: International Society for Technology in Education. Copyright 2012 by International Society for Technology in Education. Reprinted with permission.

Mooresville continues to experience academic success in 2014-15. MGSD reports that they remained "solidly in the top five in the state for the fifth straight year. Coming in at the number three spot, MGSD's overall proficiency stayed steady at 71%" ("MGSD Remains Steady on State Tests," 2015, para. 1).

Glenbrook School District 225 in Glenbrook, Illinois published a *Digital Learning Pilot Report* in 2013, evaluating instructional technology tools and the impact on teaching, learning, and student achievement. Students are White (73%), Asian (16%), Hispanic (7%), Multiracial (2%), and African-American (2%). The district is 15%

economically disadvantaged. Glenbrook's report described their journey of integrating instructional technology tools, sharing the teacher and student experiences and the desire for feedback on the appropriate device that served teaching and learning needs. The formal feedback collected via survey data showed substantive increases in engagement (20%) and learning/getting better (9%). Students reported that collaboration and project-based assignments with the technology were the most engaging activities.

Teacher data also highlighted the benefits of the 1:1 device. A high majority of teachers (80%) reported that integrated technology in a 1:1 environment benefitted learning and 60% of teachers reported that the technology provided a great deal of engagement. While this data does not demonstrate the measurable student performance results of Klein ISD and Mooresville, the *Learning Pilot Report* provides valuable feedback via teacher and student voice.

Glenbrook District 225 met with teacher and student participants from their technology pilot and solicited feedback on the success or failure of 1:1 technology. One teacher shared, "A 1:1 environment gives students the ability to research, create, solve problems and collaborate in ways that they couldn't before. We were experimenting and learning with the kids. That created a whole new level of education for the kids, too." Students added some outstanding feedback as well, with several different quotes cited below:

- Student 1: "I loved that fact that leaning could be more interactive and it encouraged us to think and use our brains not only for the skill we were leaning in class but learning experiences as well. This helped to keep us engaged."
- Student 2: "We had what we needed right in front of us. It helped me stay organized, it was easy to use, and it was quicker to access and find information than without the device.

- Student 3: “Devices provide easy access to learning tools that we otherwise would not have and it also expands the different array of activities that we can do in class.”
- Student 4: “I liked that I had access to an abundance of information and it made life easier and better because I had access to online experiences/ practices all that time.”
- Student 5: “Learning tends to be more fluid. It made the learning experience more enjoyable and we had access to better resources including more time with the teacher and others.”
- Student 6: “It allowed for us to learn wherever and whenever we wanted. I liked that this allowed us to be more efficient…” (Glenbrook District 225 High Schools, 2013)

Student voice is a valuable resource when measuring the success of a new initiative. In the Glenbrook 225 pilot, students chose words such as organize, help, enjoyable, efficient, and they described how learning is expanded and easier. Glenbrook 225, Klein ISD, and Mooresville each understand that it is about students and their desire for learning that drives the movement to 1:1 computing. As technology shifts and resources available to teachers continue to expand in schools, these districts demonstrate that 1:1 technology, likely with professional development and strong principal leadership, can positively impact student achievement.

SECTION THREE: METHODOLOGY

Research Design Overview

The research design of the District A 1:1 Chromebook pilot utilized a mixed-method design. The mixed-method design was based on input from District A stakeholders at the cabinet level. The superintendent and leadership team value qualitative-based feedback results, especially when quantitative results may be null or may not support qualitative results. The schools and community value the "voice" of students, teachers, and parents, and as these users bring forth formal recommendations for this program, these users should have input on the "various design options and kinds of data" (Patton, p. 385) used during this program evaluation. District A collected initial qualitative survey and interview data as part of the original pilot. This program evaluation used that existing District A qualitative data, but also acquired quantitative student academic performance not used in the previous pilot evaluation by the District. This program evaluation further analyzed the qualitative and quantitative data sets and triangulated results within the constructs of the research questions.

Quantitative data was collected from existing District A databases that identified student demographics, school and course information, and academic grade performance during the 2014-15 school year. A mixed-method survey was implemented to triangulate and validate participant feedback regarding student academic performance as well as the culture of learning within the technology-centric classroom. Finally, teaching teams participating in the pilot were interviewed and their data codified to further triangulate conclusions from the survey and academic data.

The pilot of 1:1 Chromebooks started in December 2014 and was completed in May 2015. Quantitative data from the PowerSchool Student Information System were queried and the data included first and second semester course grades and grade point averages. Scores in semester one was compared to semester two to evaluate if the participation in the technology pilot could be considered an independent variable impacting student performance. This data was stored electronically in a password-protected excel spreadsheet on a password protected network shared folder. Access to the file was protected through District A technology password requirements for all computers and users.

Survey data were administered anonymously to students, teachers, and parents using the online survey tool Survey Monkey. Student participants were provided the option to withdraw from the pilot at any time and parents and students signed a District A permission form that included information regarding data collection and survey participation. The Survey Monkey site is password protected and all data downloaded followed similar password-protected excel spreadsheet protocols described earlier. Survey questions regarding academic performance were collected for each participant group and then triangulated with qualitative responses corresponding to grade and grade point average data trends. Survey data were also evaluated for responses regarding changes in the classroom learning culture supporting the evaluation question, "What changes in instructional practices occur with the implementation of 1:1 Chromebooks?"

Teacher interviews were the last component of the research design for this program evaluation. Three teacher-teams participated in the Chromebook pilot and their interview responses were recorded and quotes identified. Teacher quotes are codified

within the content of each of the research questions and then aligned to specific trends identified during the quantitative data collection and subsequent data analysis.

Participants

The primary participants in this program evaluation were District A students and teachers. The Board of Education approved a $50,000 expenditure for the purchase of 120 Lenovo Yoga 11e Google Chromebooks, with similar size and level courses at each high school campus. The Director of Curriculum and Director of Technology worked with Associate Principals of Curriculum to determine which teachers and classes would best provide relevant feedback on the efficacy of this technology. Selection criteria focused on non-honors, general and special education students; teachers with a demonstrated aptitude for technology integration; and courses with co-taught teaching assignments. The rationale for focusing on non-honors students is that the district desired to see the results for the "everyday" student. As the pilot was only for one semester, the District identified teachers who had already used existing Chromebooks carts as those staff would not require extensive professional development with the technology tools. Finally, co-taught classes naturally created structures of collaboration with teacher participants. The thought was that teachers with existing collaboration relationships likely communicated regularly and this existing relationship could lead to greater opportunities for technology integration with shared responsibilities and experiences.

Participants at the High School N campus were enrolled in an American Studies course, a two-period combined English and Social Studies course certified English and Social Studies instructors. Forty-three students were enrolled in the course during the second semester of the 2015-16 school year. It is important to note that in April 2015 the

Social Studies teacher left the pilot for a FMLA maternity leave of absence and was replaced by a long term substitute.

Participants at the High School C campus were enrolled in an identical American Studies course with English and Social Studies instructors. The American Studies class at High School C was enrolled with twenty-nine students. With the desire to have at least 100 students participate, High School C selected a co-taught Junior English Preparatory course to also participate in the pilot. The Junior English Preparatory course was comprised of regular and special education students who struggle academically. The teachers were a certified English teacher and a certified Special Education teacher. Junior English Preparatory was a one-period course, and two sections participated in the 1:1 Chromebook pilot. One section was comprised of nineteen students, the other section had thirteen students.

Students were notified in November 2014, of the selection of their course for this pilot. District administration held information meetings for parents on selected evenings, and students were provided information during their course instruction. Parents and students received an information letter via mail regarding the technology pilot and district evaluation purposes. Parents and students were required to sign a consent form for students to take the device home. Parents were participants and observers of the educational and social impact of the technology in their home and through any changed academic habits that the device may have contributed.

Various District A staff were participants as well. These included district administrative staff with pilot implementation and management responsibilities,

Associate Principals for Curriculum for teaching and learning oversight, and technology staff tasked with maintenance and support if necessary.

Data Gathering Techniques

The data collected for the District A 1:1 Chromebook pilot included a combination of quantitative and qualitative data sources. Quantitative data were collected from the District A student information system consisting of demographics such as school, student ID, gender, and ethnicity. Student performance data were also collected. This data consisted of first and second semester course grades and cumulative grade point averages. Student participants included regular and special education. The data were analyzed for student grade performance, comparing one semester to another, as well as a comparison of grade point average.

Survey data were collected from students, teachers, and parents. Most of questions used a Likert scale, with some questions including an open-ended free response for additional feedback. Students who were average to struggling learners were able to speak to the impact of having a Chromebook at school and at home for academic purposes. Student survey results supported their position that the device aided their academic performance, provided better organization, or engaged them in class. The survey data also included questions regarding classroom practices and teaching and learning activities during the second semester. Teacher surveys provided a professional perspective on the impact of Chromebooks to academic performance. Teachers report noticeable changes in student behavior, participation, collaboration, and work completion. Finally, parents could report on their satisfaction with the pilot. Parents spoke to student adoption of the tool, noticeable behavior changes and, ultimately, if they

saw “value” in expanding the pilot to a business model where parents purchase or share the cost of the device in future years.

Data Analysis Techniques

The primary method of analysis was looking for common themes in the quantitative and qualitative data sets. The first theme that I focused on was student performance, specifically, did the data support the proposition that technology tools improved writing, reading, research skills, work completion, and organizational skills. Student grade data were compared from semester one to semester two, looking for statistical significance. SPSS was also be used in evaluating survey data for correlations surrounding both research questions.

The second theme to be studied was classroom culture, looking specifically at classroom management, student responsibility for learning, participation and engagement. Teacher surveys and interviews identified how the device affected traditional teaching strategies and if additional or new teaching strategies were implemented during this pilot.

SECTION FOUR: FINDINGS AND INTERPRETATION

As part of the evaluation of the Chromebook pilot, District A collected student participant demographic, school, and semester grade point average data for the first semester of the 2014-15 school year, providing a baseline of student performance prior to the implementation of the 1:1 Chromebook pilot in the second semester. The same quantitative data were collected at the conclusion of the pilot, and I examined the data to assess if there was a statistically significant change in academic performance during the four-month pilot. District A also distributed survey data using Likert scale and open-ended free response questions to student participants, their parents, and the six participating classroom teachers. The survey data was analyzed specifically relating to student performance, student engagement, and changes in the classroom instructional environment. Finally, as part of my job responsibilities, I conducted three independent teacher team interviews at the immediate conclusion of the pilot in May 2015. The responses of the teacher teams were analyzed for patterns with the grade point average data and/or survey responses.

Student Academic Performance – Quantitative Data

Quantitative data measures assessing the efficacy of 1:1 Chromebook technology were very limited in this study. Student academic progress was collected on a holistic level, looking at grade point average trends during the 2014-15 school year. Student participants were distributed among two schools [Table 4], with 39 students at School N and 57 students at School C. School N and School C are the only two high schools in District A. School N had an even balance of gender distribution with 20 females and 19 males participating. School C was weighted heavily with 36 males and only 21 females.

Overall, District A student participants by gender [Table 5] were 41 females and 55 males.

Table 4 - Student Participant Gender Crosstab by School

Gender * School Crosstabulation

Count

		School		
		N	C	Total
Gender	Female	20	21	41
	Male	19	36	55
Total		39	57	96

Table 5 - Student Participant Gender Frequency

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	41	42.7	42.7	42.7
	Male	55	57.3	57.3	100.0
	Total	96	100.0	100.0	

Baseline data for participant grade point averages in semester one of the 2014-15 school year were collected and analyzed using SPSS. Ninety-five of the 96 student participants are included in the data, as one student transferred into the District in January 2015. Of the ninety-five participants, the mean GPA [Table 6] for District A was 2.393. School N was above the district mean at 2.546 and School C was below at 2.286.

Table 6 - Student 2014-15 Semester 1 Mean GPA by School

Report

Semester1GPA

School	Mean	N	Std. Deviation
N	2.54651	39	.663630
C	2.28623	56	.803808
Total	2.39308	95	.756734

The District A standard deviation for all grade point averages was .756, which is a typical range for a four-point grade point average scale [Table 7]. The standard deviation reflects a wide range of academic performance abilities within the cohort of students participating in the pilot. Baseline data analysis by gender [Table 7] reflects female students having a higher mean grade point average than their male counterparts. Female students (N=41) had a mean GPA of 2.55 and male students (N=54) had a mean GPA of 2.273. This gender GPA difference could be attributed to maturity levels and organizational skills which are typically more highly developed among female students (Lawrence, A. & Jesudoss, I., 2011, p. 248). Female students also have a larger standard deviation than males, .811 compared to .696. Female students overall had more students with grade point averages of 3.0 and higher.

Table 7 - Student 2014-15 Semester 1 Mean GPA by Gender

Report

Semester1GPA

Gender	Mean	N	Std. Deviation
Female	2.55037	41	.811411
Male	2.27367	54	.696472
Total	2.39308	95	.756734

The 1:1 Chromebook pilot began with students receiving their devices at the end of semester one, and the expectation is that grade point average data trends will reflect little to no measurable statistical impact as the pilot lasted four months of school.

Table 8 - Student 2014-15 Semester 2 Mean GPA by School

Report

Semester2GPA

School	Mean	N	Std. Deviation
N	2.38464	39	.881476
C	2.30568	57	.870466
Total	2.33776	96	.871189

Table 8 identifies a decreasing mean grade point average differences between schools, with the mean falling to 2.337. School N decreased the mean grade point average from 2.546 to 2.384 and School C increased slightly from 2.286 to 2.305. Note also an increase in the standard deviation or the grade distribution, increasing from the total of .756 in semester one to .871 in semester two. This increase could be reflective of several variables, such as students becoming more or less focused on their academic work in the second semester, students leveraging the technology, students having an apprehension and aversion to the technology, the academic content being more or less rigorous, interpersonal issues for the student, etc.

An analysis of the mean GPA for all students reflects similar downward trends in overall student performance from one semester to the next semester. In school year 2013-2014, the mean GPA for all students declined from 3.177 in semester one to 3.158 in semester two. In 2014-2015, a similar trend occurred where in semester one, the mean GPA was 3.214 and in semester two dropped to 3.207. Looking at the mean GPA

changes from the first semester to the second semester with all students does not indicate that the pilot student mean GPA decrease from 2.393 to 2.337 is significant.

An analysis by gender, Table 9, reflects similar trends, with female students (N=41) grade point average decreasing from 2.55 to 2.514 and male students decreasing from 2.273 to 2.205. Notice the increase in standard deviation for both males and females from semester one. This increase in standard deviation may indicate that some students were able to leverage technology resources to improve academic performance and with some students it may have been a distraction, but nothing definitive can be proven with such a small data set.

Table 9 - Student 2014-15 Semester 2 Mean GPA by Gender

Report

Semester2GPA

Gender	Mean	N	Std. Deviation
Female	2.51476	41	.921844
Male	2.20582	55	.815003
Total	2.33776	96	.871189

The final quantitative statistical analysis of the grade point average uses the paired samples T Test methodology, as each student participant in the pilot has a first and second semester grade point average in the data set. This method was chosen because it can determine if any significant data changes exist from semester one to semester two grade point averages. Ninety-five student results were compared using SPSS, with the mean results, Table 10, nearly identical at 2.393 for semester one and 2.362 for semester two. The mean change from semester two from semester one is -0.030. The paired sample data had a high correlation of .790 [Table 11], as would be expected for grade

point average changes with the same student, with the second semester GPA is reflective of first semester grades and prior academic performance. The P-value is .569 [Table 12], indicating that these data do not demonstrate a statistically significant difference between semester one and semester two.

Table 10 - Student Paired Samples Statistics – GPA Semester 2 v Semester 1

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Semester2GPA	2.36237	95	.841601	.086346
	Semester1GPA	2.39308	95	.756734	.077639

Table 11 - Student Paired Samples Correlations – GPA Semester 2 v Semester 1

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Semester2GPA & Semester1GPA	95	.790	.000

Table 12 - Student Paired Samples Test – GPA Semester 2 v Semester 1

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Semester2 GPA - Semester1 GPA	-.03071	.52447	.053810	-.137557	.076125	-.571	94	.569

Student Academic Performance – Qualitative Data

Student survey responses indicate that the device had a positive impact on their learning and education experience. Three questions in the District A "Student 1:1 Chromebook Survey align with student achievement. The questions were:

- Question 34: My grades improved once I got a Chromebook. (76 responses)
- Question 33: I learned better when I was able to have regular access to a Chromebook. (75 responses)
- Question 10: My writing improved as a result of having a Chromebook. (74 responses)

Seventy-six students responded to the survey, or 79% of the ninety-six student participants. Using a four-scale Likert model of strongly agree, agree, disagree, and strongly disagree, responses to each of these questions weighted toward agreement. While quantitative data may not reflect a measurable impact on student performance, student participants agreed or strongly agreed that their grades improved with access to a Chromebook (N=52, 75%). Students agreed or strongly agreed that they were able to learn better as a result of having a Chromebook (N=58, 78%), and they believed that their writing improved with 1:1 access (N=54, 71%).

Parents and teachers were also surveyed, albeit with fewer responses, but did mirror similar responses to student surveys. Twenty-eight parents responded to the "1:1 Chromebook Parent Survey" and 67% (N=19) of responses indicated they agreed or strongly agreed that they "noticed a positive change in my students' grades" (Question 8). Teacher responses (N=5) agreed or strongly agreed at 100% that "having a 1:1 pilot generally improved student learning" in their class. Teachers also agreed or strongly agreed (N=2, 50%) that homework completion improved.

All teaching teams participated in independent focus group interviews at the conclusion of the pilot in May 2015. One teaching team was located at School N, with one English and one Social Studies teacher, and will be notated as Team 1. Team 2 was comprised of one English and one Social Studies teacher at School C, and Team 3 was comprised of one English teacher and one Special Education teacher from School C. Team 1's English teacher provided positive feedback specific to student achievement. He indicated that, "students improved their critical thinking in research, knowing when to use Google versus a research database." He also indicated that this cohort of 1:1 students exceeded his expectations with their, "categorization of knowledge…what you should know…" when prepared for an essay. He indicated that he saw students holding teachers accountable, expecting written feedback for online submissions. The English teacher from Team 1 concluded that his professional judgment is that this 1:1 cohort finished stronger than other cohorts. He could not "quantify" this observation, and indicated that he could not attribute the success to the addition of the 1:1 technology or if it was the natural ability of the cohort.

Teacher Team 2 indicated that they had mixed results with regards to student achievement. They indicated that students took a greater role in leading instructional experiences and provided an example of students introduced new technology resources and methods for efficiency and creativity with learning activities. They indicated that they did not feel that their students could discern appropriate types of resources when conducting research, in direct opposition to the comments of Team 1. Teaching Team 2 did state that they observed "improved reading with technology, that their students

keyboarded faster and more efficiently," and that their students increased communication with teachers via email and the Learning Management System "Schoology."

Teacher Team 3 provided most of their feedback through their English teacher. She indicated that students enrolled in this junior level courses started the year with very low academic self-esteem. Her students entered this course with two years of very negative experiences with high school, stating the students receive their practice ACT results, and are coming to a "recognition that they will not be reaching their dreams." She indicated that they are typically classified as "struggling learners" in school. In describing student achievement and the 1:1 pilot, this English teacher noted that some students were, "completing writing assignments at the same level" of her regular Junior English class. She stated that for some students, what was typically a three-page research paper was now six pages and more detailed. She also explained that the 1:1 device provided opportunities for students to feel like experts. She reflected that her students were typically not "blessed with extensive background knowledge" on a topic, but noted that the Chromebook provided the opportunities for immediate research and sharing out. The knowledge the students lacked they could research online and find answers. The English teacher and Special Education teacher did indicate that some students continued to struggle, and typically did not put forth any academic effort. While some students took "ownership" of their learning, others continued to not participate or even bring their device to school.

Student Engagement – Qualitative Data

The literature review indicated that student engagement is critical to academic success and the District A survey and interview data reflect the impact that the 1:1

Chromebook pilot had on students. Student surveys provided the largest and most relevant audience regarding classroom engagement. The questions asked in the student survey relating to student engagement were:

- Question 7: Using my Chromebook as a learning tool, I was more engaged in classwork (75 responses).
- Question 8: I collaborated more often with other students once I had a Chromebook (75 responses).
- Question 12: I took more ownership of my learning as a result of having a Chromebook (76 responses).
- Question 13: I remained focused, not distracted, with Chromebooks in the classroom (75 responses).
- Question 15: The classroom environment (structure, mood, and atmosphere) improved during 1:1 Chromebook pilot (75 responses).
- Question 24: I was able to get more work done during the day using the Chromebook, like during lunch or a study hall (76 responses).

Using the Likert four scale response described earlier, students selected "agreed" or "strongly agreed" to each of the questions. Question seven clearly identifies the topic of classwork engagement, and 80% (N=60) of students agreed that the Chromebook contributed to their personal educational engagement. Question twelve identified student engagement via ownership of a student's personal learning and 72% (N=55) agreed or strongly agreed. Students reported that they remained focused (73%, N=55) and collaborated more frequently (68%, N=51) because they had a Chromebook. Most students felt the classroom environment was improved (84%, N=63). Finally, students reported they were more efficient, being able to use the Chromebook to accomplish school work during non-instructional times during the day (86%, N=66). These results are echoed in the teacher survey results.

All teachers responding to the survey (N=4) reported that students "engaged more frequently with classmates" (100%, N=4). Some teachers also responded that students

were “more productive in their work” (50%, N=2), but not all teachers agreed that students “were more focused.” Only one teacher agreed with that statement, and three teachers were neutral.

Teacher interview comments were both positive and negative in regard to student engagement. Teaching team two indicated that students “found time to use (the Chromebook) as a procrastination tool,” trying to access social media and non-instructional websites. Teaching team two also observed that more students were engaged in activities, “the quieter kids had more to say.” Teaching team three indicated that they felt some students “took ownership of their learning, but that some students did not want to participate.” The teacher thought that some students did not want to use or take the device for fear of financial obligations, despite the fact that was not an actual possibility.

Instructional Pedagogy Changes – Qualitative Data

The introduction of every student having a device caused significant changes to instructional design, most often the teacher’s role shifting from teacher-centric to a student-centered constructivist model. While most of the data regarding instructional design are reflected in teacher feedback via interview data, student surveys allude to the impact of 1:1 technology on classroom. Students (N=76) did notice a change in peer editing, sharing that they, “gave other students feedback on their work more often because of a Chromebook,” with 60% (N=46) agreeing or strongly agreeing. Students also indicated that technology provided a vehicle for “increased organization” of electronic materials because of having a Chromebook, with 89% (N=68) of students agreeing or strongly agreeing.

Teachers reported at 100% (N=5) that "having a 1:1 structure changed how they instructed class." Teachers agreed or strongly agreed (100%, N=4) that learning became more student driven and focused with regular and ongoing access to a Chromebook. Team two reported during their interview that they noticed that students "worked more independently," and that, as instructors, were trying to assess if this change was positive or negative. Team three also noted this change, sharing that students "got to work more quickly." Both teams reported that the engagement and independence with the device provided greater opportunities for students to start and engage in the learning activity.

Teachers also observed that the Chromebook decreased disciplinary issues that would typically occur when using a traditional computer lab. All three teaching teams, during their interviews, identified that computer lab time presented challenges of time off task, traveling to the location, logging in, and generally that the "change of venue" was distracting. Team one's teacher reported that student behavior in a computer lab is like a "free day," that students mentally do not take the activity seriously. He concluded that with the "device every day, (students) acted differently," and that the classroom provided a more natural learning environment.

Teaching teams all concluded that the Chromebook provided in class, anytime, anywhere technology resources, whether planned or unplanned. Team one noted that with the Chromebook, they had more time on task and had increased "formal writing opportunities." Team one also added that research became a, "daily activity instead of a separate unit." As English teachers with instructional goals regarding categorizing knowledge, identifying different research strategies and tools, and discerning authentic research-based information versus general "Google" searching, the Team one English

teacher reported that the Chromebook was invaluable in achieving these goals. Teams two and three reiterated the increased opportunities for writing, for research to be completed in class and for the opportunity to utilize the expertise of the teachers and their peers. Team three shared that the Chromebooks provided opportunities for teachers to give "live intervention and monitoring" of student writing. Students shared their writing assignments throughout the process, creating a true writer's workshop model, which could not have been accomplished without every student having a Chromebook.

Teachers identified a significant shift in the use of electronic resources contributing to the change of the classroom paradigm. Knowledge that was traditionally textbook and teacher based, was now being accessed through online resources and the District A Learning Management System "Schoology." A learning management system is a web-based collaborative portal where teachers and students can share resources, participate in private discussion threads, submit assignments, and keep a calendar of timelines aligned to a course syllabus. Team one teacher indicated that it was perfect timing that Schoology was being introduced the same year that the pilot occurred. He indicated that the learning culture shifted to using Schoology for agenda and documents, and that students could share documents, videos, and other resources, even if they were discovered after traditional school hours. The Team one teacher added that he noticed that class discussions that typically ended at the end of a class period could now extend, as students continued to respond via posts in Schoology. One downside noted by Team two was an increase in plagiarism with increased access to technology. Both teachers on team two reported that students had to learn the concepts regarding electronic information, copyright, citation, etc.

Teachers reported that instead of presenting information and being the disseminator of knowledge as traditional classroom instruction model, they found themselves allowing students to do more "investigating on their own" to learn the concepts. Teacher survey results indicated that 100% (N=4) agreed or strongly agreed that their classroom culture shifted to more student-centered, student investigation. Team three added that they felt as teachers they provided more opportunities for students to "figure it out," taking steps in moving toward a constructivist teaching model. Team three described this shift as increasing flexibility with their lesson design, and that this shift gave students opportunities to be experts.

Finally, teachers' surveys reported that classrooms involved in the 1:1 pilot, "increased their use of online assessments," and that they found greater ease in conducting formative assessments. Teachers described technology tools for quick start-up activities or end of day "exit-slip" responses via an app or survey. These real-time formative assessments guided the teachers to modify instructional plans as necessary. Teachers (100%, N=4) also noted that student assignments became more application-based products or productions. Teaching team one shared that the History Fair assignment, which was typically a tri-fold poster, saw many more students developing websites and creating video documentaries as submissions.

As a researcher, my expectation was that students would naturally begin collaborating with other students during out-of-school hours. Contrary to that expectation, the data clearly indicate that this shift had not occurred during the pilot. All three teaching teams concluded that this had not become part of their academic culture and they had not set it as an "expectation or norm" with regards to 1:1 learning. They did

share that they found students participating in academic work via Schoology, assignment submissions, etc., but they did not believe that students collaborated with other students after school.

Student Survey Data – Quantitative Analysis

The final analysis includes fourteen survey questions identified as relating to student performance or student engagement. The objective in the analysis is to conduct a two-part analysis. The first step in this analysis was to use a factor analysis in SPSS, using the individual survey responses to identify if the survey captured dimensions of student performance or student engagement. If the data reflect this result, the second analysis would be to determine how these fit together. Step two will conduct a scale-reliability analysis using Cronbach's alpha to determine if the fourteen questions fit together. The fourteen questions analyzed in the factor analysis were:

1. Using my Chromebook as a learning tool, I was more engaged with assignments.
2. Using my Chromebook as a learning tool, I was more engaged with classwork.
3. I collaborated more often with other students once I had a Chromebook.
4. The Chromebook allowed me to work with other students on assignments.
5. My writing improved as a result of having a Chromebook.
6. I gave other students feedback on their work more often as a result of working on a Chromebook.
7. I took ownership of my learning as a result of having a Chromebook.
8. I remained focused, not distracted, with Chromebooks in the classroom.
9. I used my Chromebook appropriately in class, using it for learning, not social, purposes.
10. The classroom environment (structure, mood, and atmosphere) improved during the 1:1 Chromebook pilot.
11. I was able to work done during other times of the day using my Chromebook, like during lunch or a study hall.
12. I access more and better resources because of access to a Chromebook.
13. I am able to keep my materials and my work better organized when I have my own Chromebook.
14. I learned better when I was able to have regular access to a Chromebook.

The SPSS Factor analysis identified the Kaiser-Meyer-Olkin [Table 13] sampling adequacy at .885 which is close to .90, a very good sampling standard. As the Sig. value is 0, the data reflect that correlations in the data do exist and the analysis is appropriate to move forward and analyze Eigenvalues.

Table 13 - Student Survey Questions - KMO and Barlett's Test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.885
Bartlett's Test of Sphericity	Approx. Chi-Square	603.867
	df	91
	Sig.	.000

The factor analysis – Total Variance Explained [Table 14] identifies three possible variables reflected in the chart below. One variable, component one, has a total

Table 14 - Student Survey Questions – Total Variance

Total Variance Explained

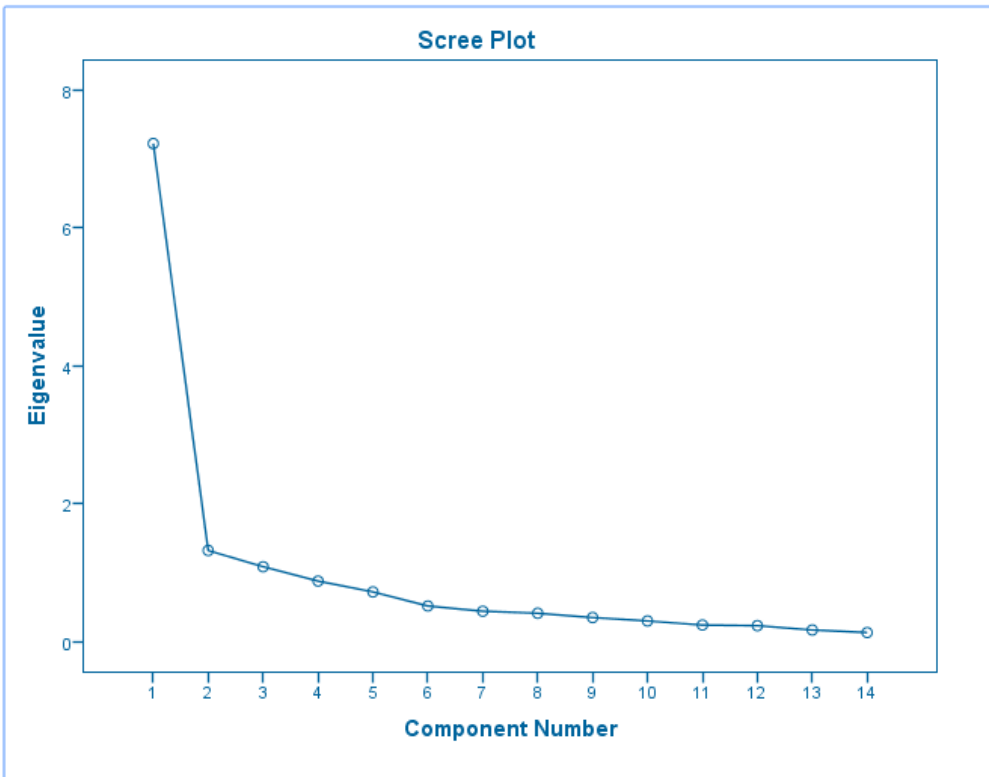
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.225	51.605	51.605	7.225	51.605	51.605	6.273
2	1.321	9.434	61.039	1.321	9.434	61.039	4.137
3	1.085	7.747	68.785	1.085	7.747	68.785	3.718
4	.877	6.262	75.047				
5	.719	5.135	80.181				
6	.515	3.679	83.861				
7	.439	3.139	87.000				
8	.410	2.928	89.928				
9	.348	2.482	92.410				
10	.298	2.129	94.539				
11	.239	1.707	96.246				
12	.229	1.637	97.884				
13	.167	1.194	99.077				
14	.129	.923	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Eigenvalue of 7.225, dramatically higher that component two or three identified in Table 15, Scree Plot, indicating that realistically one factor is identified as the strongest thread in the survey responses. I believe that student Chromebook usage can be identified as the variable as it was introduced instructionally in the second semester of instruction.

Table 15 - Student Survey Questions – Scree Plot



The subsequent second analysis of the survey data, based on the identification of one factor through the factor analysis, was to conduct a scale reliability analysis.

Table 16 - Student Survey Questions – Scale Reliability Statistics

Reliability Statistics

Cronbach's Alpha	N of Items
.926	14

The analysis looks at the relationship among the survey questions and determines if there is internal consistency within the data set. The result is termed Cronbach's alpha, and a value close to 1 demonstrates a coefficient with high internal consistency. The scale reliability analysis [Table 16] of the fourteen survey questions results in a very high score of .926, indicating these survey questions have internal consistency with the primary factor of Chromebook technology. Based on this high score, I believe that these research questions have validity, and could be used with a larger pilot of students or during the rollout of a 1:1 program district-wide. If District A performed a formal rollout of devices to all grade-levels, I would want to conduct this same set of survey questions to see if similar results and reliability results exist with a larger data set.

Interpretation

The primary goal of education is to increase the knowledge and skills of every student. As society evolves, so too do instructional practices, resources, tools, pedagogy, and the student learners in classroom. With the challenges presented by Wagner to remain globally competitive, District A and I studied the pilot of 1:1 Google Chromebooks, with the goals of determining the impact of this technology tool on student academic performance, student engagement, and instructional practice. The student and teacher participants had the devices for four months of classroom instruction and the hypothesis was that measurable quantitative data demonstrating increased academic performance would not be discovered, but that survey and interview data might indicate individual experiences. Students are very engaged with technology, and so the hypothesis I held was that survey and interview data would demonstrate an increase in classroom engagement. Finally, instructional practices with the introduction of a technology device

with every student every day would certainly lead to teacher reflection and a willingness to implement different lesson strategies. The teachers involved in the pilot did have to volunteer to participate and likely sensed a professional responsibility to participate as they understood they would report out and be interviewed at the conclusion of the pilot. Based on these factors, I expected teachers to indicate some changes in instructional practice, but not a complete shift to a constructivist student-centered learning environment, as the teachers lack experience and knowledge of this paradigm.

The quantitative data, as expected for such a short period of time with this pilot, did not reflect measurable academic growth through the analysis of grade point average increases for this cohort of students. Grades, in general, are reflective of a mix of objective and subjective measures, with different teachers determining what constitutes academic success. While the quantitative data do not support student academic gains, certainly the survey and interview data do indicate that students, at some level, demonstrated academic growth. Students indicated, via the surveys, that they believe their writing improved and that their grades increased. Teachers and parents concurred, via surveys, that they believed student learning improved. Teacher interviews pointed to a similar conclusion, as they referenced improved writing skills of some students, improved critical thinking and research resources, and that traditionally struggling students felt like experts. These data do provide some measure of academic growth for students.

Both students and teachers reported that students were generally more engaged with the learning process as a result of the assignment of a Google Chromebook. Survey data show students taking ownership of their learning, remaining more focused and

collaborating more with peers on academic work; they expressed the belief that the Chromebook was the reason that they were more engaged (80%, N=60). Teachers agreed, noting in the survey that students were engaged more frequently and some teachers concluded that students were more productive with the device than without. Teacher interview data concluded that "quieter" students increased in participation, yet they also concluded that technology, at times, served as a procrastination tool for some students. The research of Michael Fullan speaks extensively on the importance of the "New Pedagogy" (2013b, p. 24) whereby learning is engaging to both students and teachers. Fullan suggested that student engagement is required for the success of the individual's learning and academic growth; the preponderance of the data presented in the surveys and interviews concluded that student engagement did increase during this 1:1 Chromebook pilot.

In the "New Pedagogy" (2013b, p. 24) Fullan calls for schools to shift to a constructivist, student-centered teaching model. Survey and interview data showed some instructional learning changes took place in District A pilot teacher classrooms, as would be expected for a four-month pilot. Students indicated that the technology provided them tools for electronic organization of information and that they could provide other students feedback on their work more often. All teachers reported that student learning became more student directed. The same teachers also reported that the 1:1 structure "changed" how they instructed class and several teachers provided examples of these changes during interviews. For example, teachers discussed a writer's workshop model, where teachers were able to monitor student writing in real time. Teachers also noted a shift to more electronic resources, leveraging the Learning Management System, Schoology. Teachers

and students shared documents and videos and participated in online discussions and websites through this platform. The teachers also noted that the instructional learning environment changed as real-time data informed pedagogy. Technology provided regular opportunities for formative assessment via entry and exit slip type assessments and teachers could immediately modify instruction as needed. While these teacher descriptions do not reflect Fullan's ideal constructivist model, they certainly reflect changes in instructional pedagogy.

SECTION FIVE: JUDGEMENT AND RECOMMENDATIONS

The literature review provided examples of successful district-wide implementation of 1:1 technology with measurable student performance gains identified by state test scores. Project RED also identified characteristics of top performing 1:1 school districts; high on the list of characteristics was principal leadership. The data analyzed for the District A 1:1 pilot did not include annual state testing data collected (e.g., PARCC and ACT scores). Furthermore, principals were supportive of the pilot, but never took a lead role as was suggested in the Project RED report. In a district of 3,000 students, the pilot of 100 students and six teachers represented about 3% of the school population. Administrative expectations for clear shifts in student performance, student engagement and classroom instructional design would certainly be limited given the small sample size.

The students participating in this pilot used the devices in one instructional class and could use the device if appropriate in other courses. Students did not work academically in a school culture where every student had a device and where every teacher used technology tools and resources to enhance learning. Teachers participating in the pilot typically taught five sections of classes a day; only one section of students were participating in the pilot. Pilot teachers, even though working in teams, worked in isolation within their building as they did not have colleagues teaching the same courses with 1:1 Chromebooks. The pilot teachers were limited with a one-course pilot, not having other class periods for continued practice and innovation. The findings of the quantitative data reflect that Chromebook usage did not impact student achievement and

the cultural isolation and time limitations placed on students and teachers likely reflect no changes in grade point average.

The qualitative responses in surveys and interviews reflected increased student engagement and an increase in writing/research skills; these changes were unanticipated. As a researcher with such a short-term pilot, considering the lack of instructional experience by teachers in a 1:1 model, the expectation was that results would reflect little or no change in student performance or student engagement. The positive feedback of students, correlated through the fourteen survey questions, regarding student achievement and engagement indicate that Chromebook usage improved their learning experience. For students participating in a four-month pilot, the personal impact was measurable, based on their survey responses. Student voice needs to be considered strongly in the program evaluation recommendations.

Change occurs on a major scale when all parties experience the same level of change. Klein ISD, Mooresville, and Glenbrook 225 are experiencing measurable change as their leadership team developed a vision for 21st Century school and learning structures. Leaders like Dr. Mark Edwards of Mooresville recognized that, "technology has played a significant part in improving teaching and learning though increased student engagement in Mooresville classrooms. Laptop computers have significantly enhanced the level of student interest, motivation, and engagement to learn" (Greaves, et al., 44).

For District A to effect change of this magnitude, the superintendent and leadership team would need to develop a vision and plan for change. As a district administrator, I have specific responsibilities to achieve the goal of implementation of 1:1 for all students; the first steps begin with a shared vision.

District A will need to develop a vision of 21st Century learning. This can be accomplished through sharing research articles such as those identified in the literature review, site visits to other schools, leadership team discussions, and highlighting student/teacher success stories. I have the responsibility of communicating best practices, educating stakeholders on trends and peer school district initiatives. My first goal would be a collective vision of every student with a device, with a shared understanding for why this is imperative to academic achievement.

A major component of a 1:1 initiative is funding models. I will need to inform the chief financial officer of business models used by peer districts for initial investment and ongoing financial support. In District A, the initial investment for 1:1 for every student is $1.5 million and most school district do not have that level of capital resources available. Peer school districts without capital reserves have leveraged a shared cost model with families, a 100% parent purchase model, and some districts have tiered the rollout of devices by grade level. Starting with one or two grade levels the first year can ease the initial capital expenditure and can make parent cost models more amicable if payments are spread out over multiple years. Whatever business model is selected, being educated on practices of other school systems is of value.

Technology initiatives of this magnitude can also incur support requirements that require additional staffing. Again, experienced school districts can speak to strategies for device distribution, ongoing technical support, and staffing strategies used. This research will need to communicate with those districts, present options and alternatives, and create budgets around each model.

"A school principal's ability to lead is critical to the success of an implementation effort" (Greaves, et al., 2012, p. 10). Principals may not naturally be experts in the field of educational technology, and the Director of Technology is responsible for leading, modeling, and educating their professional peers. Principals can be assisted by providing research and communication about best practices, can be assisted in helping form, inspire, and share the vision for 21st Century teaching and learning, and can work with stakeholders. The Director of Technology needs to work with the principal and the leadership team to plan technology acquisition and distribution, teacher professional development, instructional implementation, and student assessment of and for learning. Critical is the principal's modeling of 21st century skills such as online learning and technology supported synchronous and asynchronous collaboration. Project RED data reflected that "the principal is one of the most important variables" and that they, "have a major impact on technology use in schools" (Greaves, et al., p. 15). Supporting their change leadership is of utmost importance for the Director of Technology.

Ongoing support of teachers and students in this process will be key to keep momentum and focus on student centered learning. Teacher capacity has been started with a few forerunners from the pilot, trailblazers who can support other experts and develop capacity for just-in-time professional development for lesson and unit integration. District A will need to have dedicated instructional technology coaches, a position currently not part of the staffing plan. As the Director of Technology, I will assist principals and human resources with the creation of a job description, and mentor eventual hires on best practices for teacher professional development. Student leaders have been developed as well and these students can build the vision with the board of

education, community, and teachers. These students can speak about the technology tools, and how this device transforms the classroom, increases engagement, and how they can leverage the device for learning.

District administration will have the critical roles of maintaining a balanced budget, providing ongoing professional learning, developing principal capacity for leading in a technology-rich high school and supporting the changing instructional design of 1:1 classrooms. Administrators will need to continue with program evaluations such as this report, assessing student academic performance, student engagement, and changes to instructional setting. Student, teacher, and parent voices will inform and educate leaders on 1:1 learning; district administration must continue to have focus groups, advisory committees, conduct surveys, and, most importantly, regularly communicate with students. Students are the educational customers and their voice and satisfaction with teaching and learning is key to success of a 1:1 technology integration.

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