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The Role Of The Technology Coordinator In Supporting The Successful Implementation Of A 1:1 Chromebook Initiative

Justin Cutts
University of New England

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THE ROLE OF THE TECHNOLOGY COORDINATOR IN SUPPORTING THE
SUCCESSFUL IMPLEMENTATION OF A 1:1 CHROMEBOOK INITIATIVE

By

Justin Cutts

BA (CSU Sacramento) 1999
MS (National University) 2002

A DISSERTATION

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ABSTRACT

1:1 Technology programs continue to increase in popularity across the United States and beyond. This phenomenon has the potential to increase student engagement and achievement. Previous research has demonstrated that devices alone do not guarantee this outcome. While many studies have examined the key factors for implementing a 1:1 technology program, few have examined the role that Technology Coordinators must take in professional development to maximize this implementation. The purpose of this transcendental phenomenological study was to understand the relationship between a high school Technology Coordinator's understanding of the technological pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the impact of these capacities on classroom instruction and student achievement. The central research question of the study is: How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship influence the implementation of 1:1 of Chromebooks and their use? This researcher also addressed the following sub-questions:

- How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?
- How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

Semi-structured interviews were conducted with four Technology Coordinators at different comprehensive high schools in a district that has a fully implemented 1:1 Chromebook program. Data analysis followed Moustakas' (1994) three-step process: Epoche, Transcendental-Phenomenological Reduction, and Imaginative Variation. Three themes emerged from this study: (1) Visionary leadership and systematic involvement; (2) Digital age learning and excellence in professional practice and (3) Digital citizenship. Results revealed that creating a shared vision among all stakeholders was a key element to successful implementation along with creating individualized differentiated professional development for teachers who have varied skill levels when it comes to technology integration in the classroom. Findings also showed that school size and the pace of technology changing are obstacles for teachers who are not digital natives.

Key words: 1:1 Technology Program, Chromebooks, Technology Coordinator, Professional Development, High School

University of New England

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This dissertation was presented
by

Justin Cutts

It was presented on
March 26th, 2019
and approved by:

Michelle Collay, Ph. D., Lead Advisor
University of New England

Kimberly Roberts-Morandi, Ed. D, Secondary Advisor,
University of New England

George Sziraki, Ed. D., Affiliate Committee Member
Placer Union High School District

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION.....	1
Statement of the Problem.....	3
Purpose of the Study.....	4
Research Questions.....	5
Conceptual Framework.....	6
Assumptions, Limitations, & Scope.....	8
Significance.....	9
Definitions.....	10
Conclusion.....	12
CHAPTER 2: REVIEW OF LITERATURE	13
TPACK Framework.....	13
Standardized Testing.....	16
Technology in Education.....	18
Influence of Technology on Instruction.....	20
1:1 Technology Implementation.....	21
Teacher Professional Development	24
Technology Professional Development of Educators.....	26
1:1 Programs and Student Achievement	27
No Statistical Difference	27
Success.....	29
ISTE Standards for Administrators.....	31
Gap Analysis.....	32
Conclusion.....	33
Standards	33
Leadership	33

Professional Development for Teachers	34
Use of Technology to Improve Learning	34
Brokering the Adult Learner.....	35
CHAPTER 3: METHODOLOGY	37
Instrumentation	38
Setting	40
Participants	41
Data	41
Analysis	42
Participant Rights.....	42
Limitations.....	43
Conclusion.....	43
CHAPTER 4: RESULTS	44
Data Collection and Analysis Overview	45
Participants	47
Nico.....	48
Walter.....	52
Dante	58
Damion.....	64
Emergent Themes	68
Theme One: Visionary Leadership and Systematic Improvement.....	70
School Size and a Shared District-Site Vision	70
Infrastructure Connection to Buy-in	71
Technologies Integrated Role in Pedagogy.....	72
Theme Two: Digital Age Learning and Excellence in Professional Practice	73
Informal vs. Formal Professional Development.....	74

Digital Age Learning Expectations for Teachers	75
Professional Development Follow-up.....	76
Theme Three: Digital Citizenship Training for Students.....	77
Adult Understanding of Digital Citizenship.....	78
Pace of Technology Changes.....	79
Conclusion.....	80
CHAPTER 5: CONCLUSION	82
Interpretation of Findings.....	85
Implications	89
ISTE	90
Four Themes.....	90
TPACK.....	91
Recommendations.....	91
Conclusion.....	94
REFERENCES	96
APPENDIX A: STUDY INVITATION	110
APPENDIX B: CONSENT FOR PARTICIPATION.....	112
APPENDIX C: INTERVIEW PROTOCOL	115
APPENDIX D: SCHOOL RESOURCE/ARTIFACT DOCUMENTATION.....	118

LIST OF FIGURES

1. FIGURE 1: TPACK GRAPHIC	14
2. FIGURE 2: FREQUENCY OF ADOPTION.....	23
3. FIGURE 3: TIMEFRAME.....	42
4. FIGURE 4: PARTICIPANT DEMOGRAPHIC DATA	48
5. FIGURE 5: ISTE LEADERSHIP THEMES	69

CHAPTER I

INTRODUCTION

Technology in education is in the midst of a major transition. Over the past decade, the *1:1 device to student movement* has swept across the nation at a rapid pace, putting a Chromebook or similar device in the hands of every student not only during the school day, but at home as well. From 2012 to 2016 the number of these devices has nearly doubled in public education institutions across the United States (Herold, 2016). As money for technology tools has increased and the cost for handheld devices has decreased, school leaders have worked to give students easier access to curriculum and academic supports through the distribution of Chromebooks, iPads, or similar devices. A recent EDNET (Schaffhauser, 2016) report showed that spending on technology has steadily risen over the past three years with 46 percent of education budgets spent on hardware. A Future Source Consulting Survey (Molnar, 2016) showed that 54 percent of all students in the US would have access to a 1:1 program in their school by the end of the 2016 calendar year. The goal for most schools implementing a 1:1 program is to increase student engagement and student achievement.

Student achievement is primarily measured by standardized tests that are web-based, adaptive, and built around the Common Core Standards. Common Core Standards, “establish clear, consistent guidelines for what every student should know and be able to do in math and English language arts from kindergarten through 12th grade” (Common Core State Standards Initiative, 2017). They represent a shift from curriculum that previously was focused on facts and recall to a focus on diving deeper into concepts so that students have an understanding of the process of learning. This shift, coupled with the change of testing in a digital format, provides a platform that necessitates the increased use of technology in and out of the classroom. This shift

also creates the necessity for teachers to utilize technology more than they ever have before, and to do so, they need quality leadership supporting them.

The problem studied was the disconnect in instruction that can come with the insertion of a Chromebook into the hands of every student. Providing technology alone does not improve student achievement. With this wave of new technology teachers must alter pedagogical practices to utilize the technology to enhance learning in all subject areas. Research has not conclusively shown that 1:1 Chromebooks in the classroom have given students the educational benefits that educators, parents, and school boards were looking for when they began these programs. While there is research that shows current 1:1 programs have demonstrated both positive and negative results regarding whether students achieve more when they are given a device to use at school and at home, there is not extensive research on what professional development (both planning and implementing programs) and effective leadership is needed by site technology coordinators to effectively implement the 1:1 use of Chromebooks (Medlin, 2016; Williams & Larwin, 2016).

The root of this question is that while 1:1 use of Chromebooks is not a quick fix to increase student achievement, Chromebooks do represent an opportunity to fundamentally change the way that students learn and interact with their instructors. However, few schools have been able to harness the potential of 1:1 programs and have them manifest into higher student achievement, nor have they been able to demonstrate that Chromebooks or any other device have influenced student achievement as measured by standardized test scores.

As previously stated, using traditional, lecture-based methods of teaching and applying those consequent assumptions of how students might learn with the addition of Chromebooks is going to yield the same results with the same problems that occur every day in the classroom

without Chromebooks. Some of the benefits of the 1:1 use of Chromebooks include easier peer to peer collaboration, easier interaction and accessibility to information from their instructor during class, and instant access to the vast quantity of knowledge available online (Danielson & Meyer, 2016; Leary, Severance, Penuel, Quigley, Sumner, & Devaul, 2016). Additionally, the 1:1 use of Chromebooks allows instructors to interact with every student in class in a manner that is efficient and non-confrontational. New interactive tools are consistently available via the Chromebook which allow a more engaging environment for students by pairing the knowledge of the instructor and class materials with interactive learning.

Applications such as EDpuzzle, EduCanon, and Zaption are three interactive video tools where instructors can insert questions throughout the lesson to check for understanding and create this interactive learning environment. Additional applications such as Pear Deck and Nearpod take existing teacher PowerPoint presentations and allow instructors to insert interactive questions, surveys, and polls for students to answer. Each program gives instant data to the instructor that can be analyzed on a class by class or student by student basis. These tools and many other provide the foundation to help teachers move into 21st century classrooms and teach students in a way that increases their achievement levels and best prepares them for college and career readiness.

Statement of the Problem

The problem studied was the limited understanding of the role of the technology coordinator in supporting the implementation of a 1:1 Chromebook initiative. Learning, understanding, and utilizing the potential capabilities of these tools is one key to the puzzle. To successfully implement technology, teachers need quality infrastructure, professional development, motivation and coaching. This requires both site- and district leadership to not

only have a quality vision but also the plan and resources to make it a reality. Levin and Schrum (2012) examined eight award-winning technology-rich schools and concluded that school- and district-level leadership is crucial when implementing any technology program. Technology Coordinators are the essential element of site level leadership when implementing technology programs. A 1:1 Chromebook program is no exception. Without quality leadership and effective professional development, 1:1 programs have proven to flounder or fail (Cho, Hamilton, & Tuthill, 2019; Peled, Blau, & Grinberg, 2015).

Successful implementation of a 1:1 Chromebook program is challenging and requires much more than just handing a device to every student on a campus. Site Technology Coordinators need skills and dispositions that will provide quality professional development to improve the effectiveness of the program.

Purpose of Study

This research specifically examined the necessary leadership skills for Technology Coordinators to possess for the successful implementation of 1:1 Chromebooks and the effect that the professional development for teachers had on that implementation. Technology Coordinators on high school campuses have a wide range of responsibilities. Their most relevant roles in relation to this study is acting as the point person to assist teachers with the use of technology and help facilitate their learning in this area. This includes understanding the competency level of each instructor and being able to personalize student learning to maximize the use of Chromebooks. Additionally, Technology Coordinators have recently taken on many of the tasks of schoolwide student assessment as it has become more and more of a digital world.

The purpose of this transcendental phenomenological study was to evaluate the relationship between a high school Technology Coordinator's understanding of the technological

pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the perceived impact of these capacities on classroom instruction and student achievement.

As technology continues to evolve, technology coordinators need to be prepared to lead their schools through this journey. The rate at which districts across the country implement 1:1 initiatives continues to rise. The goal of this research is to identify themes that can be a blueprint for others as they begin down this path. It is also highly likely that having the ability to lead a technology-rich 1:1 Chromebook school will be necessary for all future technology coordinators. In many ways, the technology coordinators in this study are pioneers in this new 1:1 world who have been able to identify and address many of the challenges that come with 1:1 implementation.

Research Questions

As the education world continues to add expectations for students, the achievement gap continues to grow and new technical and pedagogical methods are needed to close this gap. Can the 1:1 use of Chromebook programs and the interactive tools that come with them reverse this trend? The central question of the study is: How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship, influence the implementation of 1:1 of Chromebooks and their use?

This researcher also addressed the following sub-questions:

- How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?
- How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

Conceptual Framework

This research was guided by the constructivist theories of Vygotsky (1978) and Piaget (1968). Most specifically, the researcher looked at the application of their theories of cognitive development that suggests people learn better with individualized education and are able to construct their learning rather than having information given to them passively through operant conditioning, as Skinner (Gagne, 1995) argued. 1:1 technology-infused pedagogy can draw upon constructivist theory. Student-constructed learning can take place through the technological pedagogical content knowledge framework. It is important to note that for the purpose of this study, adult learners are considered students as well.

The technological, pedagogical and content knowledge (TPACK) model (Mishra & Koehler, 2009) emphasizes the importance of the combination of pedagogy, content, and technology in the classroom. The TPACK framework integrates a technological component into Shulman's (1986) theory of teacher education that emphasized not only teaching content and pedagogy as two separate entities, but rather focuses on the integration of the two. TPACK then adds technology as the third element and includes the integration of technology within each of the other two areas (TCK, TPK, and PCK) as well as integration of all three at once. Koehler, Mishra, and Yahya's (2007) study provides empirical evidence as online course participants

initially approached the three primary knowledge types as separate concepts, then established a more integrated approach after being involved over time in instructional design activities.

To create a national consensus on technology standards for educational leaders, the International Society for Technology in Education (ISTE) developed the Standards for Administrators (ISTE Standards–A). These standards break down the knowledge and skills that administrators need to be successful leader in terms of technology. The standards are grouped into five domains: visionary leadership, digital age learning culture, excellence in professional practice, systematic improvement, and digital citizenship. For each of the domains, performance indicators were added to further explain the theme (ISTE, 2009).

The first domain of visionary leadership performance indicators call on leaders to inspire a shared vision with all stakeholders to support effective instructional practice and advocate at all levels for support of this vision. Visionary leaders are expected to develop technology-infused strategic plans with this shared vision (ISTE, 2009).

The second domain of the digital age learning culture calls for leaders to provide technology resources for all students. Leaders are expected to promote, model, and establish policies that ensure safe, legal, and ethical use of technology. Additionally, they are to ensure that students learn in a student-centered environment that promotes collaboration in a local, national, and global setting (ISTE, 2009).

Excellence in professional practice is the third domain within the standards. Leaders are asked to promote professional development for teachers that will increase student achievement through the use of technology and digital resources. Leaders are expected to promote and model collaborative digital tools, stay current in technology trends and research, and encourage teachers to try new technology to continue this cycle of improvement (ISTE, 2009).

The fourth domain of systemic school improvement requires leaders to improve their institutions through the effective use of technology. This includes setting technology learning goals, engaging in data-driven decision making, hiring “tech savvy” employees, and building partnerships with outside organizations that will enhance the use of technology and student improvement. This domain guides leaders to also maintain a quality infrastructure so that technology can continue to be integrated into every facet of the way that schools function (ISTE, 2009).

The fifth and final domain is digital citizenship domain demands that leaders should ensure equitable access to digital resources. Digital citizenship requires leaders to promote and model the ethical use of not only the use of digital information but also the social interactions with technology as well. Leaders who are digital citizens are expected to facilitate an involvement in a global cultural understanding of issues through the use of collaborative tools (ISTE, 2009).

Assumptions, Limitations, & Scope

The research was done under the following assumptions. First, technology coordinators are the primary source of professional development that involves the use of technology on the high school campuses that are to be studied. Their role is to understand the different levels of competency of the teaching staff and create professional development that will help teachers maximize their ability to use Chromebooks and more effectively engage students. The scope of this research was based on high schools only. This research was limited to the four high schools in one school district that had been identified as schools that had fully implemented a 1:1 Chromebook program and that have instructional leaders that serve as technology coordinators at their individual sites.

In terms of limitations, Technology Coordinators are only from one medium sized district and do not include racial or gender diversity.

Significance

There are two layers of significance to this research. First, there are a variety of levels of technology integration that can be seen in a high school classroom. Teachers have different comfort levels and understanding of how and when to use Chromebooks to enhance their classroom-based instruction. Technology Coordinators play an integral role when using their leadership skills to build partnerships with teachers to increase their ability with and implementation of technology. This research examined which elements of the ISTE standards for administrators were deemed most essential and successful in making connections and building partnerships with teachers of a wide variety of ability levels.

Secondly, the role of Technology Coordinators is critical in implementation and design of pedagogy. As technology continues to change and advance, teachers must continually understand the current trends in technology and curriculum and instruction how these trends can directly apply to their classroom in a variety of content areas outside of their own. Although there have been many challenges seen throughout the adoption and implementation process (Sahin, Top, & Delen, 2016), this research has the potential to identify what aspects of the TPACK and ISTE frameworks are essential in designing quality implementation. This can prevent the past mistakes in future implementation efforts by districts, schools, and teachers who are beginning this journey. There are significant costs to schools and districts in terms of infrastructure, training, and resources. These costs are in addition to the average \$200-\$300 cost per device. A report by Project RED estimates that implementing a 1:1 Chromebook program costs LEA's about \$100 to \$400 per student each year. With this outlay of capital, there is an

expectation of student academic improvement by the parents, school boards, and communities who have supported this movement. This research identifies ways to maximize the spending that districts are doing and achieve the goals that have been set.

Additionally, 1:1 Chromebook access has the potential to close achievement gaps within a school's socio-economically disadvantaged and minority student groups. Students in these subgroups have a higher rate of D's and F's, score lower on standardized tests, and are less likely to be considered college and career ready at graduation. The State of California (State of California CAASPP Report 2015) shows achievement gaps with SED students scoring 24 points lower on both English Language Arts and Mathematics tests. Analysis of such testing outcomes and grades are like an autopsy of the situation. Changes must happen in the classroom where students learn the material, learn how to use technology, and then demonstrate their competency so that they are prepared when they are assessed.

Definitions

Technology Coordinator - Change agents within a school who work with teachers, site and district administrators to facilitate the integration of technology into the classroom (Masullo, 2017).

1:1 Computing - Wherein each child owns or has sole access to a computing device (Larkin, 2012).

Digital Age Learning - Any type of learning that is accompanied by technology or by instructional practice that makes an effective use of technology. This includes the application of a wide range of practices including: online, blended, and virtual learning (Cambridge Professional Development, 2019).

Digital Citizenship - All aspects of respectful, thoughtful, and ethical participation in online communities including the following nine elements: etiquette, communication, education, access, commerce, responsibility, rights, safety, and security (Jwaifell, M., 2018).

Formal Professional Development - Participants engage in activities with the expectation to learn a predetermined and specific objective or goal to acquire basic/advanced skills and/or receive in-service credit for certification/recertification (Dabbagh & Kitsantas, 2012).

Informal Professional Development - Learning that includes informal activities allowing teachers to take charge of the content and the delivery methods of their learning in a variety of formats and where learners gain new knowledge through collaboration, observation, exploration, daily practice, and reflection (Dabbagh & Kitsantas, 2012).

Shared Vision - developing a sense of common identity and practices, which from the College's perspective, derives a common understanding of the types of leaders to be developed in the profession (Senge, 1990).

Student Achievement - Status of subject-matter knowledge, understandings, and skills at one point in time (National Board of Professional Teaching Standards, 2017).

Student Engagement - Students' participation and identification with school and school-related activities including in the areas of skills engagement, participation/interaction engagement, emotional engagement, and performance engagement (Handelsman, Briggs, Sullivan, & Towler, 2005).

Socio-Economically Disadvantaged Students (SED) - Students who are enrolled in free or reduced lunch program or are designated as homeless (California Department of Education, 2017).

Conclusion

Change is a constant denominator in the world of technology and education. The 1:1 movement, however, is perhaps the most significant change that the education world has seen in the last 25 years. Putting a device in the hands of a student who can access information, curriculum, and research 24/7 is an equalizer for many students who live in a world where this hasn't historically been possible. Additionally, 1:1 programs mark a stark transition for teachers as well. Not only are teachers no longer the only resource of information, but the 1:1 use of Chromebooks can provide additional ways to learn and give instructors the ability to instantly assess individual students.

Change in classroom instruction will not happen without work by students and instructors alone. Technology Coordinators must work with staff to implement and use 1:1 Chromebooks to improve how devices are brought into pedagogy. Additionally, many obstacles stand in the way of improving student achievement and closing achievement gaps. In the chapters that follow, this researcher highlights themes that explain how successful schools that are implementing a 1:1 Chromebook program, the pitfalls to avoid, and recommendations for those just starting.

Data provided is used to illustrate gains made from the implementation of not only 1:1 Chromebooks but more specifically: the programs, trainings, and engagement strategies that were used to create these gains. Leadership characteristics of those districts with high degrees of implementation and pedagogy as measured by the TPACK framework and ISTE standards for administrators have the potential to close achievement gaps and increase overall student achievement.

CHAPTER II

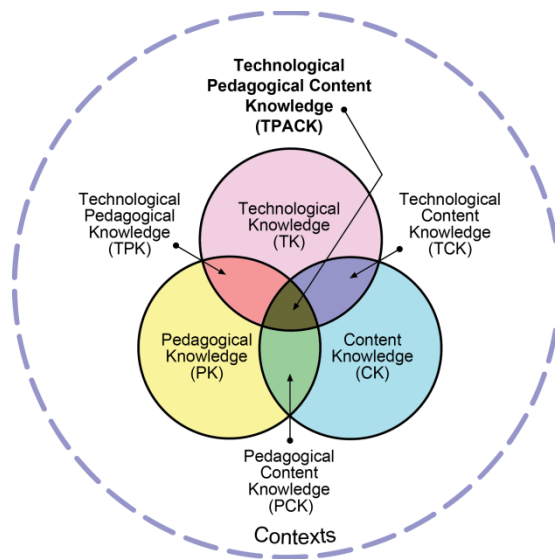
REVIEW OF LITERATURE

The chapter below is a literature review of the relevant work done in the areas of TPACK framework, standardized testing, 1:1 computing, student achievement, professional development in education, technology coaching, and the leadership capacities as defined by the ISTE Standards for Administrators. A chronological review of research in the areas of and standardized testing in education and technology in education are examined along with current research on 1:1 technology implementation and correlations to student achievement. The information below provides the conceptual framework for this research and was drawn from peer-reviewed journals, dissertations, and other work found via ERIC and Google Scholar.

TPACK Framework

The TPACK framework was first introduced by Mishra and Koehler (2006) as a tool to integrate technology meaningfully into the classroom. As mentioned, this framework was developed from the previous work of Shulman (1986). Researchers have examined strategies and methods for developing TPACK both in pre-service (Harvey & Caro, 2017; Gür & Karamete, 2015; Kopcha, Ottenbreit-Leftwich, Jung, & Baser, 2014; Valtonen, Sointu, Kukkonen, Kontkanen, Lambert, & Mäkitalo-Siegl, 2017); and in-service (Harris & Hofer, 2011; Van Vaerenwyck, Shinas, & Steckel, 2017)

For example, Kopcha et al. (2014) examined TPACK among 27 pre-service teachers. They demonstrated low levels of convergence within similar TPACK dimensions (TPK, TCK, etc.) and a lack of discrimination between dissimilar dimensions.



(tpack.org, 2012)

Figure 1. TPACK Graphic

There are many domains and combinations of domains to be found in the TPACK framework and can be seen in Figure 1. Content Knowledge (CK) refers to an instructor's understanding of the concepts related to their specific discipline. This also includes understanding the structure of the subject matter (Shulman, 1986). For example, this piece of the framework for a math teacher would include examples such as graphing equations, solving multi-step equations, calculating the mean, etc.

Pedagogical Knowledge (PK) refers to specific teaching strategies. Morine-Dersheimer and Kent (1999) define pedagogical knowledge as, "a combination of many components including classroom management and organization, instructional models and strategies, and classroom communication and discourse" (n.p.) Practical experience, personal belief systems, and reflection can shape pedagogical knowledge as well.

Pedagogical Content Knowledge (PCK), is the intersection proposed by Shulman (1986) and refers to the theory that pedagogy and content are woven together. This domain refers to an educator's ability to combine teaching methods (PK) and curricular understanding (CK) with

knowledge about students, how they learn best, and merged with the knowledge of educational goals and the ability to communicate this to students (McCaughtry, 2005; Morine-Dersheimer & Kent, 1999). For example, a math teacher uses actual statistics from the school's basketball team to teach mean, median, and mode.

Technology Knowledge (TK) refers to an instructor's skills to use technology in the classroom. This includes understanding what tools are available both in the context of hardware and software. Technology Content Knowledge (TCK) refers to the knowledge of what technology can be used in any given discipline. This includes the understanding that technology can be the tool that delivers the content or rather enhance its presentation (Harris, Mishra, & Koehler, 2007; Mishra & Koehler, 2006). An example could include a math teacher using an interactive app on a Chromebook to teach multi-step equations.

Technological Pedagogical Knowledge (TPK) is the general mastery of applying the use of technology in education, yet not specific to any subject or course. This includes the ability to innovatively use technology in a pedagogical context (Harris et al., 2007). Examples would include how to set up a Google classroom, edit a YouTube video, or create a class using an online learning management system.

Technological Pedagogical Content Knowledge (TPACK) refers to the connection made between an instructor's use of technology, instructional methodology, and their grasp of the subject matter they teach (Mishra & Koehler, 2006). Instructors who work within the TPACK framework use technology as a way to enhance their pedagogical methods while teaching content. This enhancement has shown that it can positively assist students in learning mathematical concepts (Cheung & Slavin, 2013; Cohen & Hollebrands, 2011). Furthermore, research supports that specific types of technology correlate with higher academic achievement

in mathematics as well as a student's attitudes toward the subject (Griffin, McCaffrey, & Karam, 2013).

Standardized Testing

Horace Mann is credited with being the first person to advocate for standardized testing in public education in the United States (Mann, 1867). Mann pushed for the use of standard written exams that would evaluate how much students had learned. Because the tests were the same for each school, a person could compare one school to another. Nearly 100 years later, standardized tests still exist. Like using technology in education, leaders strive to find tools to improve and assess learning. Technology implementation has been one approach, especially since the turn of the 21st century.

In 1965, Lyndon B. Johnson declared a war on poverty and passed the Elementary and Secondary Education Act (ESEA) (McLaughlin, 1975). This law brought about what is known today as Title I funding to support socio-economically disadvantaged students whose assessments show achievement gaps. While the law was also designed to increase accountability, tests were allowed to be developed by the schools themselves and therefore couldn't be compared from one site to the next.

The 1990's brought another push for schools to adopt national standards. As a result, in 1994 the Improving America's Schools Act was passed and established: "The same standards and assessments developed by a state for all children" (U.S. Department of Education, 1995). The end goal of the program was to hold schools accountable for the results of disadvantaged students and encourage schools to work towards closing achievement gaps. Eight years later the stakes were raised higher with the passing of No Child Left Behind (U.S. Department of Education, 2004). Under the 2002 law, states were required to administer standardized tests to

students in 3rd grade through 8th grade in both reading and math. Additionally, students were tested one time in high school as 9th graders. All students were expected to meet or exceed state standards in these subject areas by 2014. The major focus of No Child Left Behind was to close student achievement gaps by providing all children with a fair, equal, and significant opportunity to obtain a high-quality education.

In 2009, a state-led effort began to develop a new set of standards. Common Core Standards were developed that would be considered true national standards (Common Core, 2017). The two-year process moved schools toward curriculum that placed a heavier emphasis on college and career readiness and depth of knowledge. To date, 42 states have adopted the Common Core Standards. With new standards came the development of a new testing system. Two consortia of states that adopted the standards were created - the Partnership for Assessment of Readiness for College and Careers (PARCC) and the Smarter Balanced Assessment Consortium (SBAC). The resulting tests were computer-based and therefore allowed for accommodations for students with disabilities. In the case of the SBAC, the test is adaptive allowing questions to change in complexity depending on the right or wrong answers of the student (Smarter Balanced Consortium, 2017). With the recent adoption of these tests, there is little research on the best ways to prepare students for these assessments. However, preliminary analysis led to recommendations that schools emphasize technology tools (Doorey, N., 2012).

Huddleston and Rockwell (2015) created a historical critique of high stakes testing. Their work concluded that, historically, testing has been done for the purposes of objectivity, efficiency and accountability. Their recommendation was that standardized testing should move beyond these purposes to include performance-based assessments. With the Smarter Balanced tests moving in this direction it is essential that technology in education be used to enhance

student learning keep up with this demand. Additionally, Shanahan (2014) concludes that the emphasis for teachers with these new types of assessments should be on literacy, putting more pressure on English Language Arts teachers than ever before.

California was one of the many states to utilize the Smarter Balanced Assessment and incorporated the tests as part of their CAASPP system. The most public of the multiple measures is the CAASPP testing that is given to 11th grade students each spring that measures students' college readiness levels in English Language Arts and Mathematics (Educational Testing Services, 2017). These results are available to the public via the California School Dashboard (California Department of Education, 2017). The Dashboard "is an online tool designed to help communities across the state access important information about K-12 districts and schools. The Dashboard features easy-to-read reports on multiple measures of school success" (California Department of Education, 2017). As with other measures of success, schools and districts are rated on color scale from blue (highest) to red (lowest) in both subject areas in terms of overall score and improvement over time. Further breakdowns of data are available that show how students performed based upon socio-economic status, English learner status, and race/ethnicity. At the district and school level, overall math scores can be viewed to see individual and group student achievement. Finally, the math assessment is broken into claims where students' progress can be evaluated as well.

Technology in Education

Technology implementation has taken a long and expensive road over the last 25 years. It is estimated that in 1984, U.S. schools averaged one computer for every 125 students (Cooley, 1997). Schools invested heavily in the early 1990's in technology both inside and outside the classroom (Kasi, 2011). By 1996, the average ratio was down to 10 computers per student

(Cooley, 1997). While these early investments did little to change the face of education (Halverson & Smith, 2010), classroom procedures as well as administrative practices and data collection would see major shifts (Kasi, 2011) as computers and the internet became a more common entity in schools and society as a whole. Still, the cost for technology integration at this time remained high. In 2005, computer labs were estimated to cost in excess of \$30,000. With an average life span of five years, coupled with the fact that most larger schools had two to three computer labs, the cost for schools made it financially difficult to keep equipment current. In addition, software at the time (and to some degree, currently) was required to be purchased and installed on each device individually. An Adobe Creative Education Suite for a graphics design or video production class would cost an average school nearly \$45,000 in 2010 (Adobe, 2010).

The cost factor limited computers to a lab setting that was shared on campuses. The tide began to turn in 2010 with two specific companies leading the way. First, Apple released the first iPad in January of 2010 (Apple, 2010). This device promised a more mobile version of a laptop or other computer. Starting at \$499, the cost was similar to a desktop computer (Apple, 2010); however, it was the mainstreaming of the App Store and apps that would begin changes in education. Apps were (and still are) much cheaper than full software licenses. Software was downloaded, installed, and updated directly from the manufacturer rather than through the purchase of a new version.

The second new development came in 2007 from Google, that introduced cloud computing on a mainstream scale. Google Docs provided anyone on the internet with access to Google's equivalent to Microsoft Office (\$90/device) at no cost (Google, 2016). Additionally, Google Docs allowed files to be edited and shared with others in the "cloud" allowing access to and possible collaboration with others on files all over the world. In 2011, Google upped the

ante again with the release of Chromebooks. Chromebooks worked like a laptop but were nearly an entirely cloud-based device that only ran apps requiring minimal, if any, software to be installed on the device itself (Google, 2016). More importantly than the increase in speed and accessibility was the lower price point. Prices for Chromebooks continue to drop and can be purchased for less than \$200.

Many companies besides Apple and Google have contributed to the evolution of technology in education. However, these two companies led the way in allowing educators to move into more strategic practices. In fact, Apple is credited with the first 1:1 program in 1985 (Apple Computers, 1990). Since 2010, 1:1 device-to-student initiatives using iPads, Chromebooks, and other devices have been implemented across the globe. A 2013 1:1 global database confirmed that 80 countries had some kind of a 1:1 education program (Richardson, McLeod, Flora, Sauers, Sincar, & Kannan, 2013) while eleven more were planning some type of implementation in the next year.

Influence of Technology on Instruction

This new wave of technology allows for a new wave of innovative learning. Stukalenko, Zhakhina, Kukubaeva, Smagulova, and Kazhibaeva (2016) explored the idea of this new reality stating that the “Modern teacher has to be able not only to teach his “own” subject, but also be proficient in using innovation technologies and creatively apply them in a specific educational field” (p. 6614). This change is not only important for the modern teacher but for the modern student as well. To improve teaching and learning, teachers must provide an environment that allows for creativity. Henriksen, Mishra, and Fisser (2016) argue this point with assessment saying among other things that teachers should focus as much on the process as they do the product. This sentiment is shared with Common Core Standards and the new testing systems.

They also explain that technology has the potential to help unlock this creativity through the tools and collaboration that it provides.

This argument especially holds true in the area of mathematics. Using technology to facilitate students' learning, improve teaching, and enhance institutional administration has shown the potential to increase student achievement in the subject (Saadati, Tarmizi, & Ayub, & Ahmad, 2014). These findings were inclusive of students with disabilities as well (Akpan & Beard, 2014). Hegedus, Dalton, and Tapper (2015) demonstrated that technology implementation in high school mathematics classrooms not only improves student engagement, but benefits their learning as well.

1:1 Technology Implementation

In order for 1:1 technology to increase student achievement, the devices must be used in the classroom once they have been distributed. There is an extensive amount of research surrounding the implementation of non-device specific 1:1 programs both at the elementary and secondary level (Bocconi, Kamylyis, & Punie, 2013; Janssen & Phillipson, 2015; Keane & Keane, 2017; Nash, 2009; Swallow, 2015; Towndrow, & Vallance, 2013). A review of these studies showed an emergence of four common themes. They were as follows:

- Communication
- Delegated Leadership
- Collaboration
- Professional Development

Communication amongst all stakeholders was a key recommendation in several pieces of research (Nash, 2009; Janssen et al, 2015; Towndrow et al, 2017). This included communication to parents about the logistics of the program especially with those that required students to “bring

your own device” (BYOD). Additionally, communication between teachers and school leaders was seen as important. This included communicating expectations and solving problems that arose within the program. Finally, communication between the school and students was a key factor, including expectations for use and what to do when something was wrong with the device. Breakdowns in these areas resulted in a reduction of the use of devices and saw teachers reverting back to non-tech lessons (Swallow, 2015).

Delegated leadership was also identified by several works to be a key component of successful implementation. As mentioned above, school leaders must communicate the vision of the 1:1 program that is being implemented (Nash, 2009). They must also delegate the work and empower those within the school system to make sure that all aspects of the program run smoothly. This includes tech services (Nash, 2009), site administrators (Swallow, 2015), teachers (Keane et al, 2017), and students (Swallow, 2015). Infrastructure is cited multiple times as a roadblock for implementation (Keane et al, 2017). Skeptical teachers and frustrated students report negative attitudes towards 1:1 when infrastructure isn’t capable of supporting the program (Swallow, 2015). Even when it is, a reliable network does not guarantee that 1:1 will be a success. Not surprisingly, campuses with teachers who emerge as leaders in changing pedagogical practices are shown to be more successful in implementation than those that do not have such leaders (Keane et al, 2017). Finally, involvement of the students as leaders was identified as another key component. Swallow (2015) argued that working with and empowering students was an ideal situation for successful implementation. Students have demonstrated the ability to police and remind themselves of positive ways to impact the program. Without this empowerment, they have also demonstrated ways to sabotage it as well (Nash, 2009).

Collaboration amongst all stakeholders was mentioned as a necessity in each study that was examined. While collaboration between schools, students, parents, and the community was seen as important (Bocconi et al, 2013; Janssen et al, 2015; Nash 2009), it was teacher to teacher collaboration that was emphasized. With any new technology there are teachers who have different levels of efficacy to use it. Reid (2017) cites a bell curve of teachers who adopt new technology. A student’s experience in a classroom that has an “Early Adopter” teacher will be much different than one who sits in class with a “Laggard” (For this research, this term is replaced with “straggler”). While there are other factors involved in what creates a quality classroom, Reid argues that, while these changes are very much a change in the way technology is used in classrooms, it is as much of a change in the pedagogical approach for teachers. Therefore, collaboration among each of the different types of teachers detailed below is essential to leveling the playing field for all students.

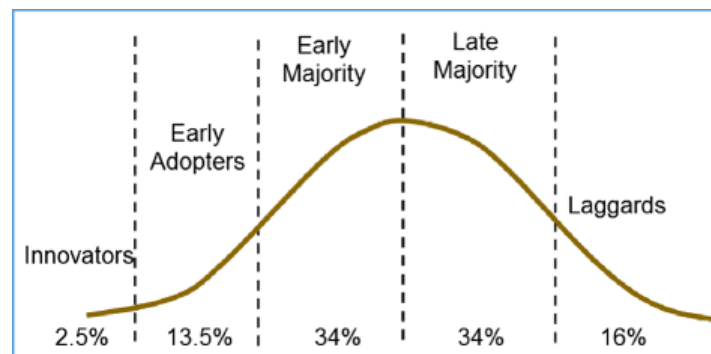


Figure 2. Frequency of Adoption. From Rogers, Everett M. *Diffusion of Innovations*. New York: Free, 2003.

Because of the differing degrees of adoption and the need for changes in pedagogy, it is imperative that teachers collaborate so that all students can receive the best instruction possible. Researchers agree, as multiple studies have shown the effectiveness of teacher collaboration (Goddard, Goddard, & Tschannen-Moran, 2007; Maher, Schuck, & Perry, 2017; Miller,

Goddard, Larson, & Goddard, 2010; Ronfeldt, Farmer, McQueen, & Grissom, 2015). This research demonstrates that teachers who collaborate more effectively not only improve their own skills at greater rates but also have students who score higher in math and English. Ronfeldt et al. (2015) concluded that teachers benefit from finding and utilizing collaborative resources, regardless of how rich these resources may be. Still others point to this richness or quality of resources as a key component to successful 1:1 implementation.

Teacher Professional Development

Teacher attitudes toward technology vary greatly. Many detractors of technology adoption argue that there is a loss of the human connection in the classroom and limits to the ability to grab onto “teachable moments” in the classroom when too much technology is inserted into instruction (Kemp, Preston, Page, Harper, Dillard, Flynn, & Yamaguchi, 2014). In a 2014 study, Aflalo (2014) found that teachers universally agreed that students needed to learn the use of computers and their applications, but they could not agree on the pedagogical benefits of technology in the classroom as a group. Some researchers would agree and argue that while technology tools as a standalone in the classroom can show either weak gains in overall student achievement or none at all (Aiyegbayo, 2015; Hew & Cheung, 2011). However, it is this collaboration piece that can begin the process to guide teachers to see the potential pedagogical benefits.

Just as with collaboration, professional development was identified as an essential element to successful 1:1 implementation in each of these studies (Bocconi, et al., 2013; Janssen et al., 2015; Keane et al., 2017; Nash, 2009; Swallow, 2015; Towndrow, et al., 2013). Through these works, there was a wide range of recommendations about not only the types of professional development needed, but also in the timing. Keane, et al. (2017) advocated not only for

professional learning before the rollout of a 1:1 initiative, but also recommended ongoing professional development as well. As stated above, Keane et al. (2017) argued for a collaborative, yet individualized approach to this type of adult learning. In looking at the factors of technology professional development needed to be successful, Unger and Tracey (2013) concluded that those providing the training must ensure that the content is relevant and practical to teachers and that it provides ongoing support and access to materials, individualized instruction and pacing, as well as the content being delivered in an easy, clear, and organized manner. Kopcha (2012), in looking at barriers to technology integration and practices, agreed in finding that in-classroom training and follow-up support was essential along with activities that align with the principles of effective professional development which he described as, “active learning, situate learning in teachers' needs, focus on teacher knowledge” (p. 1121).

While not the only key elements to a successful 1:1 implementation, these four themes set the table for 1:1 devices to be utilized in a variety of classrooms with teachers who are at different comfort levels with the technology. As with any new program, implementation takes time. Boccini et al. (2013) found that, “there is still a knowledge gap about the deeper learning practices of students using their own digital devices or the links between hypothesised outcomes for 1:1 initiatives” (p. 126). Swallow (2015) outlined a three-year and beyond timeline for integration, acceptance, and positive movement with 1:1. As 1:1 device implementation becomes more and more mainstream, the instances of programs hitting this three-year threshold are increasing. With that recognition has come research that looks at the student achievement success of schools with 1:1 programs.

Technology Professional Development of Educators

Schools often depend on professional development opportunities throughout the school year to help instructors keep up with and adapt to the new tools of technology. To effectively teach with technology, this professional development should not only take a constructivist approach but also embrace the idea of the TPACK that includes pedagogy and subject specific content. Research shows however, that technology-based professional development opportunities usually don't include information related to pedagogy and content and are not structured in a way that can support instructors effectively (Schlager & Fusco, 2003). Dysart & Weckerle (2015) propose such a model arguing that this professional development will meet these challenges by, "drawing upon theoretical frameworks and research-based methods that have been shown to be effective for developing TPACK in educators in highly specialized contexts (p. 256)." This model not only integrates content and pedagogy but relies on collaboration through peer-coaching by pairing teachers who are more advanced with those who are more novice. Baran (2015) adds to the idea of peer mentoring as an essential element to technology integration identifying the success of such a program is determined by the motivation of the teacher and how they meet the challenges that arise. Additionally, the nature of mentoring relationships and ways the peers communicate is essential to effective teacher learning. Finally, the idea of quality support is also mentioned as a success factor.

Professional development support is a key element in further research by Keengwe and Onchwari (2009) with their work in successful technology integration arguing that there must be deliberate support from technology leaders at the site level. This includes being present in the classroom to help teachers as they try to integrate new technology tools. Others have argued that this support can come from a learning community that is not necessarily confined to a school

site. Oliver and Townsend (2013) advocate for the IMPACT program which integrates this type of learning community that centers on support for successful integration of technology. This also ties in the importance of the TPACK framework.

1:1 Programs and Student Achievement

As mentioned before, there is limited research available on the achievement of students on standardized testing under implemented 1:1 programs. The studies below will examine what work has been done in the area of student achievement, both successes and failures. While many are not based on state-given standardized tests, they do give some insights to the where further research might lead.

No statistical difference. There are many examples of 1:1 technology programs that did not result in increased student achievement. Weston & Bain (2010) identify two states that rolled out a 1:1 initiative which did not result in success. The Maine Learning and Technology Initiative spent nearly \$120 million to implement 1:1 technology in 55% of their high schools and 100% of their middle schools (Maine Department of Education, 2017), yet research has shown that not all schools had implemented the program to the same degree. When 8th grade state assessment scores were examined, no significant increase had been demonstrated (Weston & Bain, 2010).

Another significant 1:1 endeavor was the Texas Technology Immersion Pilot. This involved students in 22 schools receiving computers while the state invested nearly \$14.5 million with a four-year immersion goal (Shapley, 2009). The results were similar to the state of Maine and were inconclusive. Scores in reading, writing, social studies and science showed no statistically significant differences from the control group of students. In the case of Texas, Shapley (2009) attributed this outcome to the program not being implemented with fidelity

throughout all of the schools. It is important to note that both studies were done prior to Common Core Standards being approved by most states and noting that schools may not have implemented them. Texas is not a state which has adopted Common Core standards.

A more recent study was done in the State of Missouri in regards to 4th grade achievement on standardized tests who learned in a 1:1 setting (Medlin, 2016). Test scores of students who participated in a 1:1 program had SBAC scores were compared in both ELA and math with those in a control group. Again, results were mixed but the conclusions drawn were that there was no statistical advantage shown for students participating in 1:1. In fact, in some areas they actually scored lower. Two additional studies showed no statistical advantage to math students. Bebell and Pedulla (2015) recently concluded a study of the impact that 1:1 iPads had on early learners. This kindergarten-age student study looked at students who used ipads and apps on the devices to learn versus a control group that used traditional methods. Dunleavy and Heineke (2008) conducted a similar study with middle school students comparing students using 1:1 devices with a control group in regards to performance on standardized math and science tests. Again, there was no statistical advantage between the two groups.

At the university level, researchers found similar results. Wurst, Smarkola, and Gaffney (2008) tracked honors students who did and did not have laptops over a three-year period. While the study found that classes with laptops were considerably more constructivist, there was no statistical advantage found and only a slight increase in the GPA's of the students. In fact, students with laptops reported less satisfaction with their educational experience than those in the control group. This was attributed to the learning curve that needed to occur with first year students in the program.

Williams and Larwin (2014) have perhaps the most relevant study to this research as they explored the impact that 1:1 computing had on student achievement in Ohio high secondary schools. This was based on students' performance on the Ohio Graduation Test (OGT). The OGT was required for students to receive a high school diploma (Ohio Department of Education, 2017) and was based on the Common Core Standards. Williams et al. (2014) used a sample of schools that included 24 1:1 technology adopting schools that were compared to a control school that had similar, "median income, population density, student demographic percentages for minority enrollment and poverty, and adult demographic percentages for college degrees and professional occupations, were incorporated into the methodology" (p. 147) and data over a period of 5 to 8 years was collected. Their analysis showed that overall, student performance in math, reading, science, social studies, and writing were not significantly affected by the introduction of 1:1. Again different implementation levels were cited as a reason for the lack of any statistical difference.

The seven examples above paint a bleak picture for success of 1:1 technology programs, especially when one thinks of the financial resources currently being used for implementation. What the studies do confirm is that the act of putting a device in the hand of every student is not in itself a solution. Each study concluded that more research was needed on either the logistics of implementation or the changes to effectively implement 1:1 technology into classrooms.

Success. The above research is not surprising unless one assumes that simply providing students access to technology would lead to positive results in academic achievement. Bebell and O'Dwyer's (2010) findings point towards more positive outcomes. Their work found that 7th grade students within the second year of implementation saw significant gains on the state assessments for English Language Arts when compared to a control group of students. Again, the

correlation between the strength of the implementation rather than simply the implementation itself is what showed the gains. Another benefit to ELA learning was demonstrated in the research done by Bebell, Clarkson, and Burraston (2014) that looked at the impact that 1:1 technology had on sixth graders. Students in the year-long study achieved larger average achievement gains on standardized ELA tests than the control group.

The Ozarks Educational Research Initiative conducted a meta-analysis of student achievement data (Sell, Cornelius-White, Chang, McLean, & Roworth, 2012). They concluded that 1:1 technology, “has small but significant effects on writing outcomes, probably has positive effects on 21st century skills like collaboration, self-direction, and utilization of a range of learning resources” (p. 35). The State of Missouri created a program to add computer access to all students within the state (Sell et al, 2012). One interesting fact was the conclusion that 1:1 had the potential to show increases in the area of writing. Other areas of study were mixed, but like the conclusions drawn from the Ozarks Educational Research work, there was again a connection drawn between student achievement and the need for quality professional development.

However, within many of the studies that showed no significant gains, however, there were glimpses of positive results. Despite the lack of gains in other subjects, Shapley (2009) suggested there were gains in reading achievement. Dunleavy et al. (2008) concluded that 1:1 technology supported gains in the area of science. This was particularly true for boys who have consistently been a population of students with gaps in achievement. Bebell et al. (2015) showed gains in areas as well with students showing gains in reading, writing, and phonemic awareness in kindergartners.

Grimes and Warshauer (2008) also conducted research on student achievement in PK-8 schools in California. Their data showed a drop in test scores over the first year but then a rebound and increase in the second year. Although the gains were not statistically significant enough to show an increase in achievement, the findings indicate that an implementation plan of multiple years is needed for the benefits of 1:1 programs to be realized.

Perhaps the most successful story of 1:1 comes out of North Carolina with the Mooresville Graded School District. After a four year implementation, the district went from the 38th ranked school in the State to number three. More impressive was the 20% increase in their graduation rate over the same time period (Plummer, 2012). Again this implementation coincided with professional development and collaboration as part of their plan. Additionally, the state produced a report on other 1:1 initiatives (Corn & Mollette, 2011) that showed findings of increased growth in end of grade math scores for students in grades 3rd-8th. Even more interesting were the results for high school students that showed a significant increase for English I scores for economically disadvantaged students. Small but additional gains were shown in Algebra I courses as well as a decrease in dropout rates and an increase in graduation rates.

ISTE Standards for administrators

As mentioned previously, the International Society for Technology in Education developed the Standards for Administrators (ISTE Standards–A) in 2009. These standards articulated the knowledge and skills administrators need to be successful leader in within the realm of technology. The standards again are grouped by five domains: visionary leadership, digital age learning culture, excellence in professional practice, systematic improvement, and digital citizenship (ISTE, 2009).

However, there is minimal research in the area of successful schools and the level of fidelity in which administrators follow the ISTE standards. Beytekin (2014) examined the levels of administrators' self-perception of preparedness with the Standards. Findings showed the highest level was in the area of visionary leadership and the lowest in digital citizenship. ISTE standard levels were higher with leaders who oversaw technology programs at their sites. Yieng & Daud's (2017) research showed that school leaders' demonstration of ISTE standards correlated to the success of high performing schools.

Gap Analysis

Although researchers have discovered many of the conditions that enhance learning through practice, there are still many gaps that remain open for study. These include the following:

- While there is extensive research on the implementation of 1:1 Chromebooks, there is very little in the area of leadership skills and needed by school leaders to support the implementation of these programs (Depew, 2015)
- With 1:1 Chromebooks initiatives and common core curriculum both being relatively new phenomena in education, little research looks at what professional development is needed to assist teachers in utilizing Chromebooks to provide the needed interactive experience to support the learning of this curriculum. A look at the technology integration coupled with the new pedagogy that is implemented alongside this new content is in needed (Swallow, 2015) as well as what the quality leadership skills are needed to create this impact.

Conclusion

The literature reviewed here focused on the implementation of 1:1 technology over the last two decades. It examined and reviewed the relevant work done in the areas of TPACK framework, standardized testing, 1:1 computing and its influence on teaching and learning, student achievement, professional development, technology coaching, and the leadership capacities as defined by the ISTE Standards for Administrators. While the research done thus far in the areas of technology in education and the impact that 1:1 technology has on student achievement is extensive, there is a call for further research as this is a developing and new area. This is especially true in the areas of necessary leadership skills and the long term effects that 1:1 technology can have on student learning. From this work, the following themes emerge.

Standards. The adoption of Common Core Standards fundamentally changed the way students are to be educated in the United States. The depth and level of rigor has been raised in nearly all subject levels. This rigor is evaluated on standardized tests throughout most of the country in an online format. To be successful with digital tools students and teachers must develop a comfort level with these tools. Researchers agree that just handing every student and teacher a device is not a silver bullet to increase student achievement and close achievement gaps. Instead, districts and schools must ensure that they follow the guidelines and recommendations of previous research.

Leadership. School leaders must develop a communication plan between all stakeholders. This includes district office and school personnel as well as students, parents, and community members. It is agreed that explaining and defining expectations and support helps with the use and care devices receive. Leaders need to develop a delegated leadership model that includes all stakeholders. District and site leadership must empower teachers who are early

adopters to help lead the way with new instructional practices. This collaboration is another key component that will allow teachers and students who are not familiar new pedagogy and instructional strategies to learn how to maximize the new tools they have been given.

In studies in which research regarding academic achievement was not addressed, there were concerns of the fidelity of the implementation plan. There were a variety of causes that disrupted implementation, but the consensus remains that the lack of statistical differences in achievement data were a result of the devices not being used and therefore not a difference between a study group and a control group without devices. Therefore, the conclusion is that the device itself is not the answer but how and how often it is used is the key.

Professional Development for Teachers. School leaders must provide quality professional development for teachers. This fundamental shift has been studied by many new teachers and early adopters, but there are teachers all over the spectrum who will need quality individualized instruction themselves.

Use of Technology to Improve Learning. There are disagreements in the literature about whether 1:1 programs can result in increased student achievement. While the majority of data points to little or no statistical increase as measured by standardized testing, there are other studies that show gains in a variety of subject areas. The most agreed upon subject where students had an advantage with 1:1 technology was English Language Arts. This in itself is a good sign as the reading comprehension levels for the new standardized tests has been raised, therefore making comprehension a critical component to nearly every subject area of the test.

It is important to note that there are significant gaps in the research reviewed here. Of all the studies examined, only four (Bebell et al, 2015; Bebell et al, 2014; Medlin, 2017; Williams et al., 2014) were completed after the adoption of the Common Core Standards established in 2012.

Of those four, only two used data from standardized state tests and only one (Williams et al., 2014) was based at the secondary or high school level. Even this work completed in 2014 was done before schools were able to make a full transition to Common Core curriculum. With the amount of financial resources used for 1:1 programs and the desire for a return on that investment, the need for further research in this area has never been more imperative.

Brokering the Adult Learner. Coaching teachers in the integration of technology is a difficult task. Research suggests a number of different approaches. It does coordinate some themes that coordinate with the four themes of successful implementation of 1:1 Chromebook initiatives. These again include quality communication between technology coordinators and teachers, delegated leadership of the learning that includes collaboration between teachers and either a mentor or broader technology community.

While there is much research on technology integration, there are gaps in the research in terms of level of integration. Nearly all of the research to date focused on the post-secondary or early childhood educational settings. None of the research reviewed examined the application of these programs in the K-12 world, nor addressed the specific dynamics of a secondary site.

The literature does suggest that 1:1 Chromebook initiatives will be most successful when school leadership has a belief system that aligns with the ISTE standards for administrators and the TPACK framework. The study focuses not only on Technology Coordinators knowledge of the standards and framework but also their ability to align the themes identified in the literature review above. Most of the research done to this point has been on the effective ways to implement 1:1 and what gains in student achievement have or have not occurred. This research has been done primarily in an era prior to the full implementation of Common Core and mainly at the K-8 level and does not specifically look at the professional development that was done for

teachers to improve student achievement. With this transition beginning its fourth year in many states, this research has the ability to fill the gap that currently exists within the field, especially the gap that exists at the secondary level.

CHAPTER III

METHODOLOGY

A qualitative phenomenological design was selected for this study to address the research questions. In this chapter, source of the setting, participants, qualitative data sources, their analysis, and collection methods are discussed. As mentioned earlier, this study examined a 1:1 Chromebook implementation from the perspective of site Technology Coordinators who are taking on this initiative and developing professional development to support it. Understanding the perceptions and attitudes of the sample group of technology coordinators is a critical piece of learning about the leadership skills needed to for successful implementation. This approach may be considered another step in learning how to manifest quality leadership into increased student achievement and a more enriched learning experience.

More and more schools and districts across the country are adopting some form of 1:1 Chromebook into student programs. However, data indicates that many 1:1 technology programs by themselves do not result in increased student achievement (Weston & Bain, 2010). For 1:1 Chromebooks to be successful, programs need to be paired with professional development, shared leadership, and high quality collaboration and communication (Bocconi, Kampylis, & Punie, 2013; Keane & Keane, 2016; Swallow, 2015; Towndrow & Vallance, 2013). The TPACK framework provides the basis for methodology in this research. Based on this prior research, the researcher identified a high school district that has fully implemented a 1:1 Chromebook program. To analyze the effectiveness of the implementation of the 1:1 Chromebook program in terms of enriched student learning and increased student achievement, the researcher sought to answer the following questions.

How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship influence the implementation of 1:1 of Chromebooks and their use?

This researcher also addressed the following sub-questions:

- How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?
- How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

This research was conducted using a non-experimental descriptive design to examine the perceptions of technology coordinators in one district using 1:1 Chromebook technology. To accomplish this, the researcher conducted interviews of the technology coordinators of the four comprehensive high schools which was used to gather thematic data. This methodology allowed analysis of these themes that were discovered. The interview protocol was designed to allow the researcher to collect qualitative data for this study.

Instrumentation

Technology Coordinators in the researched district were the site representatives for establishing and implementing the district's vision for technology in education. Technology Coordinators are selected by the principal at each site with the selection based on their ability to lead the staff in making this vision a reality. To do this, the expectation is that they will create differentiated professional development on how to better utilize technology in education. As the

district moved to 1:1 Chromebooks, technology coordinators must include a much broader spectrum of teachers in their coaching practices and more fully assess teachers' ability level with technology.

To gather data for this research, the Technology Coordinators at each of the four high schools were interviewed to find themes of the leadership skills they used and professional development they created to implement this vision. These interviews were conducted using questions based on conceptual framework including the TPACK framework, ISTE standards for administrators, the four themes of successful 1:1 implementation, and the definition of success for 1:1 implementation. The researcher met with each participant individually who was given a definition of successful 1:1 implementation prior to the start of the interview. Each individual was given a series of prompts to respond to with this definition in mind. The prompts were designed to extract information about leadership skills and professional development provided to reach this definition of success. The questions were tied directly to the ISTE standards, TPACK framework and the four themes of successful 1:1 implementation. A review of research work showed these four common themes to be:

- Communication
- Delegated Leadership
- Collaboration
- Professional Development

(Bocconi, Kampylis, & Punie, 2013; Janssen & Phillipson, 2015; Keane & Keane, 2017; Nash, 2009; Swallow, 2015; Towndrow & Vallance, 2013).

Setting

The participants and data in this research primarily involved the four comprehensive high schools of the Pheidippides Union High School District (PUHSD). This is a pseudonym. Pheidippides Union High School District is located in Northern California. At the time of this study, the district was comprised of four comprehensive high schools, a continuation high school, and an independent study high school. The campuses range in size from 150 to 1700 students with a total enrollment of 4137 students (California Department of Education, 2015). Geographically, the schools are separated by an average of about 20 miles with each school being the only high school in their respective communities. The communities vary in economic affluence (11.2%-72.1% free and reduced lunch) however, the district free and reduced lunch rate sits at an average of 26.5%. The EL population does not have as wide of a range with only a 0-4.2% difference between the schools for an average of 1.7% (California Department of Education, 2018). Communication with all schools took place via email, personal interviews, and notes that were administered online through Google Forms. No part of the study was conducted at locations outside of the scope of the district.

The 1:1 Chromebook initiative is fully implemented across all four of the comprehensive high schools in the district. Each student receives a Chromebook, cover, orientation, library card, insurance, and Google Apps for Education login with email. Wifi is available in classrooms and common areas across each campus. This access is limited to only district devices with limited capability for personal access. Initial implementation began in 2012 with the sophomore students at each high school. This continued for another year before year three when the final two classes were given devices. The class of 2019 is the third graduating class to have a device for all four years of high school.

Participants

Technology Coordinators at each of the sites were contacted to participate in the research. Schools were initially contacted through a formal email that explained the intended scope of the research. Once agreeing to participate, Technology Coordinators were contacted by phone to explain the scope of the study in further detail, to answer any questions they had, and schedule an interview time. Interviews were approximately 45-60 minutes long.

No support staff or other teachers were contacted as part of this study. A Technology Coordinator could also be a teacher, but the interview only requested information based on their role as a Technology Coordinator and leader at the school. All Technology Coordinators received results of the survey when they were available for their school and overall district data was shared as well. Pseudonyms were assigned to the district and each school so that no identifying information was reported that would allow Technology Coordinators to identify data from other schools.

Data

Interviews conducted were then transcribed and coded into themes using a constant comparative analysis. Each interview was transcribed verbatim. Each transcript was then submitted to the person interviewed to check for fidelity. Technology Coordinators reviewed the transcript and any changes were made. The interview transcripts were then reviewed again by the Technology Coordinators until the transcript accurately reflected their intent. Follow-up contact was made if necessary after the interviews to collect evidence of data that was recorded during the interviews.

Figure 3. Timeframe	
October 2018	Identify and contact technology leaders for research
October 2018	Schedule Interviews
November 2018	Conduct interviews and review transcripts
December 2018 - February 2019	Data analysis, review revise findings
March 2019	Submit Findings

Figure 3. Timeframe

Analysis

Qualitative data was then coded into themes in order to analyze each technology coordinator's and school's individual experience. Codes were generated from the data in relation to the ISTE educational leader standards, TPACK framework, and the established four 1:1 themes. This was accomplished by assigning a keyword or code to different sections of the transcript. These keywords/codes were then applied to different-sized sections of the transcript that could vary from segments that were merely phrases all the way up to larger sections that consisted of whole paragraphs. This approach assured that all data was represented correctly from the Technology Coordinator's perspective.

Participant Rights

The Technology Coordinators who participated in this study were made aware of their rights through informed consent. This included confirmation of their volunteerism with the purpose, description, and risks explained to them as well. An email explaining the purpose of the study along with the aforementioned participant rights document was sent at the time of the request for an interview. Pseudonyms of participants were used in the findings of this research. Additionally, pseudonym school identifiers were used in discussion data obtained via the

interviews. While these precautions were in place, it is conceivable that one could use the demographic data to identify schools used in this research.

Limitations

- One limitation of the collective case study is the element of subjectivity as the researcher was previously involved in the district's 1:1 implementation.
- The phenomenological study only deals with a small sample size of four high schools in one district. This could limit the ability to replicate the effectiveness of the findings in schools or districts of different sizes.

Conclusion

Each year school leaders embark on a journey to improve their schools and districts with the overall goal of improving student achievement. One of the areas of focus is the use of technology. School leaders play a key role in motivating, training, and providing teachers with the technology tools needed to help students. TPACK and the ISTE standards for administrators apply a blueprint for successful leadership in today's world of 1:1 Chromebook implementation.

This research aimed to analyze the application of that framework in a real world setting. Technology coordinators' role on campus is one that can assist teachers in harnessing the power of the 1:1 Chromebook programs that are offered at schools. By conducting these interviews and analyzing the data it was the goal of this researcher to provide an insight into the successes and failures that the Technology Coordinators experienced as they enacted their roles. These lessons learned can be used by other site technology leaders as they begin to implement or refine their own 1:1 device programs.

CHAPTER IV

RESULTS

Chapter IV presents the findings of this transcendental phenomenological study. This chapter examines the study's process in three stages. First, there is an overview of the data collected and an analysis of this data. Second, the demographics of the participants are shared with a brief description of each participant. The gathering of demographic information and narrative for each participant allowed the researcher to acquire a deeper understanding of the leadership skills participants use in their role and the different ways they create professional development to assist teachers. The last section explores the themes and subthemes that emerged from the participant stories.

1:1 Chromebook programs serve as an opportunity for schools to increase student achievement and create a more equitable experience for students. Students who attend schools that have a 1:1 Chromebook program have the opportunity to learn via personal construction of knowledge. Researchers argue (Vygotsky, 1978; Piaget, 1968; Walshaw, 2017) that this is the most effective way for people to learn based on the idea that students learn best when they construct their own meaning. While studies showed an inconclusive view of whether or not 1:1 Chromebook programs increased student achievement alone (Bebell and Pedulla 2015; Medlin, 2016; Shapley, 2009; Weston & Bain, 2010), extensive research showed that positive results were always preceded by a successful implementation plan. These implementation plans included communication, delegated leadership, collaboration, and professional development (Boccini, 2013; Swallow, 2015).

Because few studies have examined the role of site technology coordinators for successful 1:1 Chromebook implementation, this transcendental phenomenological study sought

to explore the necessary leadership characteristics and the professional development they provide to help teachers utilize these new technology tools. The following research question guided this study:

How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship influence the implementation of 1:1 of Chromebooks and their use?

This researcher also addressed the following sub-questions:

How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?

How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

Data Collection and Analysis Overview

Data collection started in September of 2019 once permission had been obtained from the University of New England's Institutional Review Board and district administration of the high school study sites. The researcher sought the collaboration of the four Technology Coordinators at the comprehensive high schools in the district. The requirements for inclusion in the study and the contact information for the researcher was provided to the Technology Coordinators in order to set up two-way communication with the researcher about any specific questions they might have and to schedule their interview. In-person, semistructured interviews were conducted with the four Technology Coordinators individually at various locations at or near their

respective campus. The use of a semistructured protocol gave the researcher the opportunity to ask a mixture of structured and open-ended questions with the bulk of the interviews guided by the specific topics to be explored (Merriam, 2009). The first part of the interviews consisted of gathering descriptive data about each of the Technology Coordinators in order to create a profile for each. In the second segment of the interviews, participants were asked to describe their experience in working with instructors to integrate technology with pedagogy, and curriculum (TPACK). The final aspect of the interviews asked questions about their leadership style in relation to the International Society of Technology in Education (ISTE) leadership standards (2009). Interviews were audio recorded via cell phone to effectively capture data (Jamshed, 2014). The researcher transcribed interviews manually, reviewed the transcripts and emailed a copy to the participating technology coordinators for data checking (Creswell, 2007). All four of the technology coordinators confirmed via email response that the transcripts were accurate. The researcher then assigned aliases to participating technology coordinators as well as their corresponding schools in order to ensure confidentiality.

A follow up interview was done with the group as a whole after an initial review of the four accurate transcripts. Again, a semi-structured protocol was used to ask a mix of structured and open-ended questions. Structured questions were developed that addressed specific initiatives, programs, and situations that were consistent between at least three of the initial interviews. This interview also included the Director of Technology for the district. The researcher again transcribed the interviews manually, reviewed the transcripts and emailed a copy to all participants. Confirmation emails were then received that the transcripts were accurate.

The researcher used Moustakas (1994) three step process of epoche, transcendental phenomenological reduction, and imaginative variation for data analysis. The three steps were taken in an effort to negate the personal experiences of the researcher and narrow the focus to the experiences of the four technology coordinators (Creswell, 2007 and Moustakas, 1994). To begin the precoding process, the researcher reviewed each transcript four times underlining significant statements (Saldaña, 2013). Each line of the transcript was systematically examined as open coding began using a Google document. The researcher ignored statements that were immaterial (Moustakas, 1994) and focused on significant statements that were related to the research questions. These significant statements were the key elements that were used to narrow the data into themes (Creswell, 2007 and Moustakas, 1994). The demographic information gathered along with the narrative from each technology coordinator were key components in the data analysis. This information provided the researcher a greater understanding of participants' individual experiences as well as the one to one Chromebook program as a whole.

Participants

The four Technology Coordinators who were leaders at each comprehensive high school site in the district were interviewed. Four males comprised the sample population. Their ages ranged from 28-58 years old with teaching experience that included a fairly new instructor with four years of experience to a seasoned veteran of 23 years. The four Technology Coordinators ranged in experience from one to 15 years. Three of the instructors had their primary credentialed subject area as career technical education (CTE) with a fourth being credentialed in Spanish; however, this participant had a supplemental credential in CTE as well. Pseudonyms for both the names of the Technology Coordinators and their respective schools have been used below for confidentiality purposes.

Name	Age	Gender	Site	Experience	Primary Cred	Sup Cred
Nico	28	M	Golden Hill	4 yrs	CTE	N/A
Walter	48	M	Cool River	20 yrs	CTE	N/A
Dante	56	M	Verde Ridge	25 yrs	CTE	N/A
Damion	36	M	Fallen Creek	15 yrs	Spanish	CTE

Figure 4 - Participant Demographic Data

Nico

Nico had been an instructor at Golden Hill High School for four years before the 1:1 implementation of the Chromebooks. He was hired as a Career Technology Education instructor teaching freshman technology and broadcasting. He had worked for five years prior to coming to Golden Hill in the private sector as a web designer. After three years he was asked to take on the role of Technology Coordinator at the site when the current Technology Coordinator took a new leadership position as a department chair. Already seen as a technology leader on campus, Nico's web background served him well in his new role as he was able to assist teachers with a rollout of the new school website where every teacher was in charge of updating their own pages. This experience proved valuable for the 1:1 Chromebook implementation when he was tasked with distribution of devices, professional development for teachers and students, as well as troubleshooting problems of the devices and infrastructure. Nico's experiences proved beneficial to the adoption of the 1:1 Chromebook program as he had overseen the implementation of the web site program and had built a video broadcasting program. In both

instances, he was able to successfully organize a program for a large group of individuals that needed systems and people to work together who had a wide range of ability levels.

Nico takes a different approach with each group of technology adopters. With the innovator and early adopter groups he either asks them to explore a new tool on their own to give him feedback or solicits ideas from them of what new tools they are using. He is then able to share this with others at his site that would be able to benefit from something that has gotten a positive review. With late adopters and strugglers, Nico explained that helping them after being in the position for many years was still a challenge. Many teachers feel that technology does not apply to their world, their subject matter, or the way they teach. His best method was to “sneak technology into their world” or incentivize their participation to get an instructor to try a new technology tool. One example of this was level one Google Certification. The district offered a \$300 stipend to anyone who got the certification. Nico offered professional development to any teacher who needed assistance in passing the certification test. Teachers were able to come into the lab and get whatever level of assistance they needed to get certified.

Nico’s approach to the TPACK framework was much more informal. He relies on his experience with teachers to know their capacity level in terms of content, pedagogical, and technology. This he admitted proves difficult because he is not in their classroom everyday nor is he an expert in every subject. To facilitate feedback, he routinely sends out informal surveys to gauge interest and need of technology tools. These surveys are typically a short Google Form questionnaire comprised of three to four questions asking what level of expertise teachers have with a particular new tool or software and if they are interested in learning more about it. Based on the answers he knows how to move forward. With some of the more challenging teachers,

He also identified the need to personally visit teachers periodically to find out where he can be of assistance.

Professional development for Nico has also been more effective in the informal setting. He attributes this to the wide range of ability levels that teachers have. Doing a specific training is difficult because many teachers are turned off by a presentation that is either too slow or too far beyond their ability level. Nico stated it is most successful when is able to work one on one with a teacher and address specific needs. He routinely asks questions about what is the end goal that teachers have for a lesson. He then works to separate the content from the goal and tries to integrate what technology can help them meet their goal.

Nico's alignment to ISTE standards for leaders was not consistent. Admittedly, he stated that he had never specifically looked at them. He was very candid where Golden Hill was successful and needed improvement with each of the standards. Within the idea of inclusion, Golden Hill has done little specific work as a site or with specific instructors in creating equal access for all students. While the idea of 1:1 Chromebooks is to level the playing field for access, Nico pointed out that technology leaders have worked to make teachers aware that many students have limitations at home in terms of access to the internet or other materials.

Perhaps the best alignment to the standards was with created a shared vision of the use of technology. Nico was part of large group of district employees who were invited to create a vision for technology in the district. This group included employees in all departments and of all ability levels in using technology. Over several months the group met to norm what the expectations would be for the use of technology in the district. This included a one year, three year, and five year plan. While the creation of the plan was viewed as an overall success, the implementation has been a struggle. The plan was shared at a staff meeting with an explanation

of why this vision was created. Beyond that, much of what was agreed on has not followed the timelines set. Nico attributes this to fatigue with overall educational mandates required of the site. There are a handful of people that see the need to do so and want to move forward but getting the momentum to move the entire school has been difficult.

Nico also saw alignment with the standards of digital citizenship including both staff and students. Monthly, he will share out to staff digital citizenship tips along with benefits of the tool or recommendation(s). One month, Nico shared tips for teachers in regards to cheating apps that were available on phones. This included applications that could solve equations from a simple picture along with others that allowed students to hide pictures and files. He also works with teachers and the district office to maintain a secure web filter that keeps harmful material off campus but still allows teachers to access the content they need. With students, the focus has been within the freshman technology classes and working with them to understand how to be smart online. Curriculum includes an extensive lesson about students' digital footprint and how to protect it. Nico works with parents so they can take advantage of the district's option for them to sign up for a weekly email that shows their students web history.

Overall, Nico firmly believes that Golden Hill High School and its students are better off with the 1:1 Chromebook program. Teachers and students have many more opportunities since the program has been implemented. In thinking back over the implementation process he admits that the initial logistics created a slow adoption. With not all students having Chromebooks the first two years coupled with inconsistent Wifi and other access issues, some teachers were not receptive to utilizing the Chromebooks and were negative about the initiative at first.

Key findings from Nico:

- Soliciting feedback is important to know what support staff needs

- Informal professional development is the preferred delivery method
- Creation of a shared district vision was important
- Implementation at a large school site was difficult
- Digital Citizenship should be considered through the eyes of students, teachers, and parents

Key recommendations from Nico:

- Have infrastructure in place prior to implementation
- Issue all devices at one time rather than class by class
- Ensure there is a clear system of support for students, teachers, and parents

Alignment with ISTE Standards:

Nico's practices aligned to the ISTE standards the most with digital age learning and excellence in practice with the support he provided with the Google Certification process and other informal professional development he provided. He also closely aligned his practices with the digital citizenship standard providing support for teachers with professional development, students with digital citizenship curriculum, and even parents in assisting them with connection to the web filter report. Nico also aligned with the visionary leadership and systematic improvement standards with his involvement in the Technology Think Tank the process he followed with the staff at Golden Hill afterwards.

Walter

Walter had been an instructor at Cool River High School for 15 years before the 1:1 implementation of the Chromebooks. He was hired as a Career Technology Education instructor teaching a variety of subjects including design, publications, freshman technology and broadcasting. Walter also created and wrote district curriculum for his Cool River Technology

Team (CRTT). CRTT is course where students serve as “first responders” for technology issues on campus. His students field calls and digital tickets from staff members, diagnose the problem, and then either work to find a solution or refer it to someone who can. Outside of technology, Walter has also been an activities director and basketball coach at the school. After five years at the school, he was asked to take on the role of Technology Coordinator at the site when the current Technology Coordinator stepped down. Already seen as a technology teacher on campus, Walter’s design and technology customer service experience has been critical in his role with the new the 1:1 Chromebook implementation. In addition to the initial distribution of devices, professional development for teachers and students, Walter updated his CRTT curriculum to assist with troubleshooting problems and damage to the devices as well infrastructure issues. Professional development ranged from the introductory basics of how Google Docs was similar and different to Microsoft Word, how the shared feature works within the Google Suite, and the connections between email and calendar features. More advanced professional development was created revolving around pedagogy and how integrating Chromebooks and the Google Suite could fundamentally change the way instructors taught a class. One training was built to show how better and faster feedback could be given to students. In the lesson, students submitted a thesis statement for a paper they were writing. Templates were provided of the Google Form and the Google Sheet of results. The thesis statements were graded on a scale of 1-5 based on a rubric. Instructions were then given on how an instructor would review with the class examples of what each score looked like. Students then were able to rewrite their submission to meet the criteria for a five.

Walter’s approach also differs with each group of technology adopters. He treats the innovators on his campus as a team that pushes the envelope of what is possible with technology

and how it can enrich student learning. This team takes the newest tools and looks for ways to integrate them into their classroom. One example he gave was the “Assigning a Task” feature addition to Google Docs. One member of his team brought the idea of using this as a way to help with the editing process of an essay or project. Within a group he could give specific jobs to students. This process sent an email directly to the student rather than to the entire group. This allowed an instructor to save time in class by removing the need to speak to each individual within a group. With this change, the teacher could address the groups as a whole and refer them to their specific assignments.

Walter sees his role as to take what is developed by innovators and early adopters and standardize it for those who are not as tech savvy. He is very cognizant of looking at new tools and determining if they are reliable enough and easy enough to use that he should introduce them to late adopters and strugglers. One piece of evidence he provided was the conditional formatting feature within Google Sheets. One of the early adopters had been working with this feature to analyze the results of formative assessments. With the results of a Google Form dropping into the Google Sheet, the teacher used cut points with conditional formatting to color code how many students understood specific concepts. When the teacher shared this with Walter, it was an obviously effective but somewhat complicated model. Walter began using the process and looked for ways to simplify it. Once he felt he had something that could be replicated and understood by someone who wasn't a “tech expert”, he shared the curriculum with an early adopter for feedback. Eventually he was able to refine the process and share it with all staff.

While Walter admits that he doesn't follow this specific protocol for each new initiative, he does typically utilize his CRTT team to create curriculum for the team to use in instructing

teachers on how to use new tools where he sees a connection based on a conversation or email that he receives. He was quick to point out that even when dealing with veteran staff that may be in the laggard group, he works to support the value and necessity that technology has in education. He also mentioned the level one Google Certification and that while the district offered stipends to current employees to get certified, it is a requirement for all new employees.

Walter took a very analytical approach to applying the TPACK framework as a technology coordinator although he admitted he had never heard of the acronym before the interview. His approach was perhaps the most personal. At a site with only 25 teachers, it is easy for him to know each teacher's level of technology expertise and also have a general idea of their grasp of content knowledge and pedagogical ability/style. While he has no statistical data to back this up, he bases his findings on qualitative data and his knowledge of how long they have been in education and/or teaching in a particular subject area. It is through his conversations with the staff as a whole and individually that he crafts both formal and informal professional development opportunities.

As mentioned, formal professional development for Walter involves the use of his CRTT team. He applies the tenets of a good lesson plan geared for students when creating for teachers as well. This includes effective first instruction with modeling, allowing students (teachers) to explore and learn on their own, assessing what they have learned, and following up with resources for those that forget or need a reminder later on. These lessons can be delivered by Walter or a team member and have also been set up to work as stand-alone lessons available online with tutorials available as needed through the CRTT program. One key element he looks for is the style a teacher typically uses. If they do more lecturing or direct instruction, he recommends delivery resources that can give an instructor strategies for more quality

presentations. If a teacher uses a more inquiry-based strategy, he recommends discovery tools that the Chromebooks can access. For both types, he has a wide variety of assessment tools that can be used.

As with Nico, Walter felt that professional development has also been more effective informally. He attributes this to the personal connection he has with the teachers on his campus. Each year he makes it a point to meet with each teacher and discuss what they are doing new in their class. He looks for ways that technology can be integrated to help teachers dive deeper into their curriculum or work more efficiently.

Walter admitted that he had never specifically looked at the ISTE standards for administrators although his leadership style embodied many of the standards. Not only was Walter also part of the T3 team that built the district technology vision, he also worked with his staff at Cool River to develop a vision of where the school staff would like to go. He puts a focus on building a digital age culture by establishing minimum technology requirements that all teachers will meet and he personally models. This yearly process of systematic improvement has established what he feels is the most technologically savvy staff in the district.

While his staff is very proud of their accomplishments, Walter reported mixed results and work in the area of digital citizenship. While the students at Cool River receive the tech essentials curriculum, he does not have data that demonstrates the effectiveness of the implementation. Walter reports hearing anecdotal stories around campus of students continuing to make poor choices with respect to content on their electronic devices. Additionally, there have been adults on campus who are not fully aware of their own digital footprint. This has been a concern of district officials and has been something they have worked with the Technology Coordinators to communicate to staff.

Overall Walter believes that Cool River High School has had a successful implementation of the 1:1 Chromebook program. This process did take time to reach a level he sees as successful. The conversation today is that the Chromebook is a given in the classroom. There is no longer a discussion about if they should be used but rather how. As a technology leader on campus he sees this as brilliant transformation. As a manager of facilities and budgets, labs were eliminated allowing that space for very specific uses (Engineering, Broadcasting, Mechatronics, etc.). There has been reduced cost in terms of device maintenance and decreased spending as well. The system to manage Chromebook repair is now efficient and has made the campus more efficient as well.

Key findings from Walter:

- Formalizing a shared vision on campus is essential
- Smaller school size allows implementation to be an easier process
- Professional development should be personalized and coupled with follow-up resources
- It is important to have a team
- Infrastructure support is key

Key recommendations from Walter:

- Build a team to support implementation
- Create professional development for teacher as you would a good lesson for students
- Start with the “value added” for a teacher when discussing a new technology tool for implementation
- Build expectations for teachers in terms of technology

Alignment with ISTE Standards:

Walter's practices most closely aligned to the ISTE standards for administrators. This was most evident is his work in visionary leadership, helping build a shared vision both at the district level and then at Cool River High School itself. This shared vision with staff, along with his informal professional development and creation of the CRTT team, created a digital age learning culture and excellence in professional practice that created systemic improvement. While still a work in progress, digital citizenship was addressed by him through the freshman technology class as well.

Dante

Dante has been an instructor at Verde Ridge High School for 25 years. He has been the Technology Coordinator for the past 18 years including through the 1:1 implementation of Chromebooks. He was hired originally as a math teacher but quickly moved to the Career Technology Education department when there was an opening. He has taught a variety of subjects in that area including publications, freshman technology, and yearbook. Dante was asked to take on the Technology Coordinator position after the former person in the role stepped down. To him, it was a natural progression as he was already helping students with technology and he could use a similar model for working with teachers on campus as well.

Dante explains his approach with the different groups of technology adopters through the philosophy that technology itself is not an add-on. His definition is that it has to improve one's life and support each educator to create a better learning experience or increase their engagement with students in a meaningful way. The question he presents is, "Can I replace something and buy back time?" He cited an early instance in the 1:1 Chromebook rollout where it was discovered that by using Google Classroom a teacher could set up formative assessments that

could be graded through the platform and the results were then automatically pushed into the school's gradebook program. Previously, teachers would use scantrons that were then run through a machine and then the scores were hand-entered.

Working with innovators and early adopters on his campus is an easy process for Dante. He sees his role as one that mainly supports their needs as they lead the way with new ideas that can make his vision a reality. With the example above, the connection between Google Classroom and the grading program was discovered through research by one of the innovators on his campus. Initially there was no link to the grading program. Dante worked with district technology personnel and was able to articulate what needed to be done on the back end of the software settings to make this happen. With late adopters and strugglers, his role is more of a salesman as they have varied roadblocks that prevent easy integration. Dante takes pride in taking a lot of personal time making connections to what teachers are doing and in reality, doing a lot of work for them at times. In the case above, his role with them was to package this new connection, make it look easy, and explain how learning this new technique would save the apprehensive teachers time.

Dante also took a personal approach to the TPACK framework. He admitted that he had little to no knowledge in regards to the subject matter that many teachers teach. In regards to pedagogical ability, he was quick to point out that much of what leaders think about a teacher's ability may not always be the case. His initial response was that he tries to differentiate instruction with teachers as to not make the mistake in assuming that all teachers within the same subject area teach the same way. One example he used was with his work implementing Nearpod with his teachers. One teacher he worked with saw his presentation and used it as a in class presentation tool that finished with a formative assessment allowing her to see real time

data on what students understood on a specific concept in Language Arts. A second Language Arts teacher used the program as a presentation tool that students accessed outside of class and then used class time as an opportunity to fill in gaps that weren't understood by students. At a site with over 60 teachers on staff, Dante felt that it was important to realize that there was a wide variety of approaches to pedagogy. Again, through his personal conversations with the staff and group surveys he is able to gauge what professional development is needed in different departments across campus.

One interesting observation he had was the correlation he saw between the way specific teachers taught and their use of the 1:1 Chromebooks. In his observation, he felt that teachers he knew did less direct instruction and more “self-discovery” (as he called it) were more likely to integrate the Chromebooks into their class. This observation came as had discussions with teachers as they learned more and more of what Chromebooks were capable of. He realized after around the second year of the program that more and more of what he was being asked to help teachers with was primarily applications and/or activities based around student-centered learning. This included applications like the example above in Nearpod. Another example was the implementation of Google Suite and his work with the Mathematics department. One student-centered activity that the department does on a weekly basis is the “graphing the grade” assignment. Students plot their overall percentage each week and then write a reflection answering what change has happened in their grade, what caused that change, and what their plan is for the week to either improve or change the grade. The activity was typically done in a notebook and parents were supposed to sign off each week. With Google Sheets, Dante was able to help the department set up a template that students could use that connected a spreadsheet, graph, and summary section. He also coached the teachers on how to have students set up

notifications so that an email was sent directly to parents when the document was updated each week. Making this change made the activity and receiving credit for it more about the student's reflection and not about whether the student could remember to get the notebook signed.

Dante leads formal professional development on a monthly basis. Time is allotted for him at each staff meeting to give an update of a new technology tool or feature within an application or device that the staff utilizes. Dante keeps the updates short, simple, and hopefully easy with additional information available for those that are interested to find out more. He has online resources ready ahead of time and is personally available if anyone needs one on one assistance. Typically these sessions are made up of about 15-30 minutes of direct instruction with 30 minutes of lab time available. Over the course of the last year his topics have included Google Docs, setting up your gradebook, Nearpod basics, advanced Nearpod, Kahoot! Basics, Google Classroom basics, and more.

Dante also favors informal professional development sessions where he able to work with one or a few staff members. This is especially true with campus and district wide initiatives like 1:1 Chromebooks. After the initial roll out, Dante met with each department to gather information on how the devices could improve instruction and engagement for them. Dante then proceeded to set up short lab sessions for each area of need where an extended version of his staff meeting presentations with teachers immediately being able to begin working on their own application. Dante available to answer questions or help troubleshoot problems as they occurred. With monthly staff meetings, Dante would typically set up one session a week for each topic. Some of the topics included the basics and advanced features of applications such as Nearpod or Kahoot along with advanced features of the Google Suite like how to set up a Google hangout or any new feature that had been released within Google Docs or Sheets.

While Dante knew of ISTE as an organization, he also had not reviewed the standards for leaders. Dante was also part of the T3 team that built the district technology vision but he admitted that Verde Ridge did not have a shared vision for technology. With such a large staff, there seemed to be too much differentiation required for the teachers to reach an agreement regarding what the vision should be. This has made developing a digital age learning culture across campus difficult. He estimated that 50-60% of the staff would be looked at that way, with a smaller percentage either indifferent or totally against technology in general.

Dante also gave his site mixed results in the area of digital citizenship. Freshman at Verde Ridge also get the tech essentials curriculum but the difficulty is in keeping up with the changes in technology that students use and ensuring that the curriculum reflects those changes. This is difficult with adults as well when many struggle to learn new apps or devices. These changes have been a focus every year for the monthly lessons taught during staff meetings. Additionally, Dante reports that, within the breakout sessions at district in service days, digital citizenship is a topic that is deliberately included each time.

When looking at the program as whole, Dante reflected back on his original philosophy for technology and felt that the 1:1 Chromebook program has been a success at Verde Ridge High School. He felt strongly that the program was a key factor in giving access to students who normally would not have it. With a higher level of socio-economically disadvantaged student population than other schools in the district, it was a stark contrast from previous years to see all students with a device and know that all students would have access to a device when they went home. Per his explanation, this is a bigger concern at Verde Ridge than at any of the other schools in the district. As a technology leader on campus he sees his role as one that is key to supporting the program, especially for these students. Overall he has seen a shift in the way

many teachers are teaching now that their students have access to Chromebooks. In his observation 75% of teachers on campus report using Chromebooks within their classroom for some type of a group activity with a shared document. Fifty percent use Google classroom on a daily basis and 40% use some form of interactive online formative assessment tool. While there are still those that continue to use traditional methods of instruction, there is a distinct shift in the school as a whole.

Key findings from Dante:

- Technology should be something that saves time. Chromebooks have done that
- Larger school size and teachers with varied ability levels makes a shared vision more difficult
- Professional development can be formal or informal but informal is more effective
- Teachers who had a more student-centered teaching style were more likely to adopt Chromebooks into their classroom

Key recommendations from Dante:

- Build professional development that promotes Digital Citizenship for adults (Teachers and Parents)
- Follow-up after formal professional development is key to implementation
- Expect a wide range of pedagogies and be ready to assist with a variety of requests

Alignment with ISTE Standards:

Dante's practices aligned with the ISTE standards in varied ways. In the area of visionary leadership and digital age learning culture he and his campus struggled. This wasn't

from a lack of effort to build one, but the size of the teaching staff and the varied opinions made reaching a consensus difficult. Dante did feel that, with those that are willing, he has created excellence in professional practice and systematic improvement with the 1:1 Chromebook program. Even with those who are not, he has successfully been able to train them to understand and use the minimum level of technology expectations that the district has. With digital citizenship, Dante reports a work in progress. With students the freshman technology class he has addressed this topic well, but connecting what students know to what adults have as expectations was still an area of growth for him and the site.

Damion

Damion was hired 15 years ago to teach all levels of Spanish and French at Fallen Creek High School. After several years he also began teaching freshman technology. As a small high school, it is normal for teachers to teach multiple subjects and in multiple departments. Damion's technology interest stems from the fact that he likes keeping things dynamic and staying current on the latest tech-based offerings. Technology has always been a hobby and he is always looking for technology tools that can enhance student learning. With each new tool he asks himself, "Can I use this tool or is there a tool that can help?"

Damion launches his work across technology platforms by determining first the educators' skill levels. If questions arise at staff meetings he has the ability to then target specific individuals for follow up assistance. Fallen Creek's small teaching staff (15) facilitates an individual and personal approach. The size of the staff and the makeup of the school contributes to what Damion feels is a staff that is full of nearly all innovators and early adopters, sometimes out of necessity. They were the first school in the district to establish synchronous online classes. Students from Fallen Creek were able to take an AP Calculus class taught at

Golden Hill while sitting in the library at their own school. They participated in group discussions, asked questions of the instructor and took tests like other students. While they were supervised by someone at their own school, they were allowed to take a class that normally couldn't be offered because there were not enough students who wanted to take it. This pilot program has become a model for other classes throughout the district. When working with innovators, he shares with them things that he has learned which allows them to apply them to their classrooms. From those evaluations, he will look to streamline instructions for early adopters on staff. One example was when Google added the ability for a new annotation feature where students could complete worksheets and create visuals on documents, and teachers could then grade and comment on assignments. This was all done within Google Classroom and then the grades could be automatically pushed to the gradebook program the district used. While a complex process when one first read about it, Damion created a step-by-step process based on what one of his teachers had shown him that could be adopted by others at the school. He also shared this with the other Technology Coordinators who were able to use the tutorial at their sites as well.

One difficulty that can arise at the small site is the inability to collaborate with teachers of like subjects. What would be considered a department on most campuses consists of 1-2 teachers at Fallen Creek. Many larger schools use a Professional Learning Community Model where instructors who teach like subjects meet on a weekly basis to talk about common curriculum as well as student successes and failures. With its small departments and a remote location, this collaboration model is difficult. Dante, however, was able to build partnerships with other sites and set up Google Hangouts where Fallen Creek teachers could collaborate with other sites. Additionally, because they are a small school, 80-90% of the Fallen Creek staff eats

lunch together. This gives Damion the chance to hear what teachers do in class on a daily basis and where they have a common struggle. One concern was Google Certifications, which teachers raised during lunch conversations. Damion used in-service days to help teachers get through the process. Outside of this process, Damion admitted that they do little combined work in regards to the TPACK framework.

Damion has a very unique situation when it comes to being a technology leader on a small campus. Like at other sites, Fallen Creek gets their technology vision from district level. He then works at the site level to explain the why of the vision and answer questions anyone may have. Again, because of the small size make it easy to communicate out and get engagement. A good example of this is the adoption of a program called Portfolium. Largely given a “token” adoption by the rest of the district, Fallen Creek has fully adopted the program at the site. Damien attributes this to the factors mentioned before (small size, high level adopters, for example) and the shared vision that they have at Fallen Creek.

In regards to digital citizenship, Damion noted that there isn’t much done for staff at the site. For students it falls again to the freshman technology class. Damion shared that the district has done training for staff who teach the class to make sure that the curriculum is delivered correctly. Additionally, he also discussed the ability for parents to access their students search history and the importance of educating parents. He mentioned that community forums have been held to provide parents with information on what to look for when they see this history and what resources they had access to when something isn’t right.

Damion was the most adamant that the program had been an overwhelming success. He especially thought this was true in terms of equity. Fallen Creek also has a very high poverty rate and a Chromebook is sometimes their only computer at home and it gives students access

that they never would have had. He explained that, prior to the Chromebook program, there was little to no expectation of students to do work outside of the school day on an electronic device, while today it is an expectation. Additionally, he sees the great things that students can do in every classroom. He cited an example of a recent graduate who attended Fallen Creek with the 1:1 Chromebook program and is now taking only online classes in college. The student attributes his success in those classes to the experiences he had at Fallen Creek. Most importantly, Fallen Creek has seen an increase in CAASPP testing scores.

In looking at the 1:1 Chromebook rollout, Damion thought it went well. He felt teacher education could have been better initially rather than just a rollout of devices without a lot of teacher training. He felt training should be specific and targeted and the rollout wasn't necessarily that. The only other concern was some of the addiction issues that students are having with devices and their inability for them to put them down.

Key findings from Damion:

- 1:1 Chromebooks have given the students and staff the ability to collaborate with peers from other schools
- Small school size makes developing a shared vision and a willingness to try new technology an easier endeavor
- Since the implementation of the 1:1 Chromebook program Damion's school has seen a rise in their test scores and graduates have pointed to their experience with technology as a reason for them being successful in college

Key recommendations from Damion:

- Create a system where it is easy for teachers to communicate with technology leaders

- Common Digital Citizenship curriculum is important for students
- Use innovators within a school site to vet new apps and programs
- Expect a wide range of needs on a campus and differentiate professional development

Alignment with ISTE Standards:

Damion's practices aligned with the ISTE standards also varied with his closest connection being in building a shared vision and creating a digital age learning culture. The small size of Fallen Creek allows for collaboration and necessitates innovation. He is always looking for ways to create more opportunities for his teachers and students. In turn, the teachers there are willing to take risks with implementation. Much like Dante, Damion's alignment was not perfect. Students in the freshman technology class also addressed Digital Citizenship but furthering those expectations on to adults was still a work in progress. More extensive work with parents and staff was just beginning at the time of this research.

Emergent Themes

The researcher highlighted 11 emergent themes to better understand the Technology Coordinator leadership capacity in regards to the ISTE standards and provide support for individual teachers within the TPACK framework. The 11 themes encompassed:

- School size and a shared district-site vision
- Infrastructure Connection to Buy-in
- Technologies Integrated Role in Pedagogy
- Personal connections for Professional Development
- Informal vs. Formal Professional Development
- Digital Age Learning Expectations for Teachers

- Professional Development Follow-up
- Differentiated Professional Development
- Digital Citizenship Training for students
- Adult Understanding of Digital Citizenship
- Pace of Technology Changes

The researcher then grouped the 11 emergent themes into central themes based on the ISTE standards for administrators. Visionary leadership and systemic improvement were grouped together as were digital age learning culture and excellence in professional practice. Digital citizenship remained a stand alone theme itself. Not all Technology Coordinators experienced each subtheme, but the appearance of these sub themes and themes reinforced triangulation for the investigation. The researcher then successfully brought about triangulation by looking to find consistencies or inconsistencies in the data from more than one Technology Coordinator and then used this to create an understanding (Merriam, 2009). Table three below shows the three themes and 12 sub themes discovered from data analysis.

ISTE Leadership Themes	Sub Themes
Visionary leadership and Systemic Improvement	<ul style="list-style-type: none"> ● School size and a shared district-site vision ● Infrastructure Connection to Buy-in ● Technologies Integrated Role in Pedagogy
Digital Age Learning Culture and Excellence in Professional Practice	<ul style="list-style-type: none"> ● Personal connections for Professional Development ● Informal vs. Formal Professional Development ● Digital Age Learning Expectations for Teachers ● Professional Development Follow-up ● Differentiated Professional Development
Digital Citizenship	<ul style="list-style-type: none"> ● Digital Citizenship Training for students ● Adult Understanding of Digital Citizenship ● Pace of Technology Changes

Figure 5. ISTE Leadership Themes.

Theme One: Visionary leadership and Systemic Improvement

This theme was selected because the two participants who felt their staff shared the vision of what 1:1 Chromebooks could be used for had the highest amount of implementation. Both Technology Coordinators attributed this outcome to the small size of their school. All Technology Coordinators stressed the importance of gaining staff buy-in before the program could be considered successful. Technology Coordinators also viewed quality infrastructure as a key component as a means to getting staff engaged. They also regarded the role of that technology could play within a teacher's pedagogy as a key component to solidifying a vision for instructors. Nico summed it up by stating, "Our initial rollout for 1:1 Chromebooks was done quickly to get the devices into the hands of the students It wasn't until we had the infrastructure and a shared vision within our teaching staff that we started to see the full potential that the program could provide." The four sub-themes within the shared vision theme were (a) School size and a shared district-site vision (b) Infrastructure connection to buy-in (c) Technology's integrated role in pedagogy

School size and a shared district-site vision. Both Walter and Damian attributed their success of creating a shared vision with the staff early in the 1:1 Chromebook implementation was due in part to the small size of their school. Cool River has a teaching staff of only 25 teachers while Fallen Creek is even smaller with 15. Both Technology Coordinators indicated that they sat down with their staff after the district had articulated the vision for the 1:1 Chromebook program. Together they worked to develop what this vision would look like at their school. Damian remarked, "We gathered a lot of feedback after we shared the technology vision from the district but with our small size there wasn't a lot of push back. It was more about how we could move forward and what meant." Contrastingly, the larger schools struggled with

the shared vision. Both Technology Coordinators from Golden Hill and Verde Ridge said their first attempts at sharing the district vision and selling that to their respective schools was met with resistance over initial logistical issues. Nico stated, “Our first couple of meetings there were more questions about why things didn’t work or weren’t consistent and it made it hard to get anywhere with the real “why” we were doing this with the size of our staff.” All Technology Coordinators had high aspirations for the 1:1 program, and most of them shared that their sites have come to a vision that is largely in line with the district although there are always those that haven’t totally bought in.

Infrastructure Connection to Buy-in. All four Technology Coordinators mentioned problems with infrastructure when discussing what they wished would have gone differently with the initial rollout of the 1:1 Chromebook program. Damion, Nico, and Dante specifically mentioned connectivity concerns with the initial rollout. Students and teachers complained to them that the system was plagued by the inability for all devices to connect, students being kicked off, or just slow connectivity in general throughout the school day. Inconsistent service was another issue that was mentioned with teachers who taught in multiple classrooms throughout the school day and one that hindered buy-in from the beginning. Damion explained, “We had several teachers who had a lesson that would work first block on one part of campus but when they moved to a different building in the afternoon, suddenly they ran into problems. That made it difficult to convince them that this was going to be a useful tool.” Additional infrastructure issues included the way the schools were asked to handle devices that were damaged or stolen. Originally, parents were encouraged to purchase third party insurance when the devices were handed out at their cost. Students with damaged Chromebooks who did not have insurance were left to either pay for the cost of replacing the device or repairing it. Even if

a student did have insurance, the process was cumbersome and out of the hands of the Technology Coordinators despite the fact that parents were looking to them for answers. Nico stated, “The damage and stolen process at the beginning was beyond frustrating. Parents wanted answers and we didn’t have them. Many times students who didn’t have insurance were stuck with a debt that their family couldn’t afford. It just put us in a bad position.”

The initial infrastructure problems left teachers and students frustrated. Many instructors refused to implement the devices based on the assumption that the tool wasn’t reliable. Several parents and students refused to get new devices for fear of accruing more debt. Based on Dante’s recollection, it wasn’t until year three that the program grew to be a campus wide movement.

Dante elaborated:

At the start of the third year we did the distribution that made it so all students on campus had a device. Teachers had heard that the bandwidth issues had been resolved and the district began to buy insurance for all students. This alleviated the fears many people had and we finally felt like we could make some progress with those that were initially hesitant.

Technology’s Integrated Role in Pedagogy. Both Dante and Walter discussed the direct correlation between an instructor’s pedagogical methods and their approach to professional development. At each site, the Technology Coordinator informally assessed the teacher to determine the way that they delivered content and looked for professional development both formally and informally that would cater to their style. Damion and Nico mentioned this in a much more general way. Nico approached differences in on a much more personal basis by finding out what instructors thought they needed versus making that decision

for them. While Damion didn't specifically look at a specific teacher's pedagogy, his professional development was responsive to all types of instructional methods. Both reached the understanding that the dedication to the vision and the implementation to the 1:1 Chromebook program hinged on the ability of the instructor to see the relevance between the way they taught and how the Chromebooks could enhance that experience. Nico summed it up best stating, "This definitely wasn't a situation where a teacher got a device and they decided to overhaul the way they had taught for 20 years. If it could make it better or more efficient they were all over it. Outside of that it was our typical rock star teachers that were still pushing the envelope like they always do."

Theme Two: Digital Age Learning Culture and Excellence in Professional Practice

Personal connections for Professional Development. All four Technology Coordinators pointed to the personal connections they make with teachers as the most important factor in making progress with the implementation of the 1:1 Chromebook program. Damion intentionally had discussions with his staff during lunch each day to find out where he could provide professional development with individual instructors. Nico would visit individual department meetings to listen to concerns and get ideas about what teachers would like to see the Chromebooks be able to do in their classroom. Walter made it a point to have an individual conversation with each teacher at Cool River at the start of the year to try and build a positive relationship that would help him connect with staff and understand their needs. Dante would visit teachers during their Professional Learning Community (PLC) meetings to better understand what teachers were doing in class and hear the concerns they were experiencing. School size again played a role within this theme as developing personal connections was an easier task for the Technology Coordinators at Cool River and Fallen Creek. Both Nico and

Dante commented that, because they felt the personal connection was so important, he had to be very deliberate about trying to build them because their school sizes were large. Walter and Damion both found that this was an easy task based on the small size of their respective staffs. Regardless of the difficulty level, all four Technology Coordinators explained that the lack of a personal connection directly impacted their ability to provide quality professional development to teachers.

Informal vs. Formal Professional Development. All four Technology Coordinators discussed either the effectiveness of informal professional development or the ineffectiveness of formal professional development. Nico talked extensively about his frustration with the first year of the implementation of the 1:1 Chromebook program and his monthly staff meeting quick professional development modules. He would present a tool to the staff and offer follow up for anyone interested. After three months of presentations he had exactly one staff member who had inquired about one piece of a presentation he had made. It was at month four that he began working with department chairs and having informal discussions on what the Chromebooks could do in their classrooms and then giving an impromptu demonstration that he felt like he started to get buy-in for the program. Additionally, this method helped him understand the frustrations that teachers were having. In a formal setting, it seemed to him that, “Teachers were less likely to say something because they had to be there, they wanted to leave, and they were afraid if they said anything it would just make the meeting go longer.”

As mentioned earlier, Walter and Damion both took a very informal approach to building professional development. Based on the small school size, both were able to meet with teachers in a relaxed setting to determine what their needs were and how or if using a Chromebook would be something they could do. They would then tailor their lessons for teachers to be specific to

their needs. Both shared frustration in presenting formally even with a small staff. Walter explained, “Even at a school our size you still have such a wide range of ability levels. You’ve got one person who is so bored because they could probably teach it better than me and then on the other end of the spectrum you have two or three people that are completely lost. It just doesn’t work.”

Digital Age Learning Expectations for Teachers. A key to the 1:1 Chromebook program and its implementation was common technology expectations the district had for its teachers. All four Technology Coordinators spoke about the importance of this norm. All four participated in the district’s Technology Think Tank project. As mentioned prior, the implementation of the shared vision is still a work in progress for them. However, the shared digital age learning expectations had immediate impact. From the Technology Think Tank, the schools’ staffs agreed that all would use the Google Education Suite (gmail, docs, sheets, slideshow) and Google classroom where needed. Additionally, they would use the Aeries Gradebook and update weekly for the Parent access. Finally, each instructor would maintain their web page (Google based) and keep it updated with a calendar of assignment and test due dates, course syllabi, and contact information. While these expectations were really minimal in the eyes of the Technology Coordinators and almost universally used by innovators and early adopters, it allowed the Technology Coordinators to build positive relationships with instructors who were late adopters and strugglers. Damion commented, “Once we had established that the old way of doing things wouldn’t work, people were willing to take advantage of the help we were offering. Luckily we were ready with good lessons to help them.”

Setting minimum digital age learning requirements for teachers had another unintended effect. As reluctant instructors began learning how to update their page and use an online

calendar, it allowed the Technology Coordinators time with these individuals to explain the simplicity of tools that were once feared and also demonstrate how the tools could do other things in the classroom that would enhance or help their teaching. Nico explained,

As I reached out to teachers who in the third week of school still had not set their gradebooks or updated their page I was able to answer questions and ease the fears that teachers had. Many were hesitant to want to integrate Chromebooks because of the infrastructure issues we had the year before. In many instances I was able to convince them to give the idea another try and offer to help craft a lesson or an activity with them.

Professional Development Follow-up. Follow up was a common term used by the Technology Coordinators in all four interviews. Each saw their role as one of customer service although each had a different viewpoint based on the school where they worked. Still each spoke about the importance of seeing professional development as an ongoing process not just something that was done a single time. While Walter talked extensively about hardware maintenance and repair, he was also certain to always follow up any professional development that was formal or informal with a visit from his CRTT team to answer any questions that a teacher might have. This was the same for Damion, except he followed up personally and usually within the next day or two after he had helped someone. Nico's and Dante's approaches were different based on the size of their schools. Both used Google Form surveys to follow up or they would email the teacher directly to see if they had any additional questions. Nico also visited different departments each week during their Monday collaboration time to follow up and answer any questions that could be out there.

The follow-up in their mind was key to advancing the 1:1 Chromebook program as it gave them the opportunity to talk about next steps that teachers could take. Nico mentioned that

he had worked with the social science department at his school on how to use Google Docs to submit essays they write and give feedback. The next time he dropped in he talked about the group project he had seen an English teacher do where groups of four students created a timeline on a Google Doc enabling the instructor to see what exactly each student had contributed to the project. The World History instructors scheduled a time for him to show them how they could do the same with their upcoming French Revolution project they typically did on a poster board. While they didn't jump to this method exclusively, it was an option that students could use and was so widely taken advantage of that the next term saw the teachers fully adopt it.

Theme Three: Digital Citizenship Training for students

Social media and the digital age have fundamentally changed the way that students interact with each other and learn. This change was recognized by all four Technology Coordinators during their interviews. Although students grow up as digital natives, they many times still come to high school without the necessary skills to use technology to enhance their education or communicate appropriately. Nico summed it up saying, "Our freshman come in not knowing how to be smart online. The ability to share instantly is not always something that they understand what is ok to do and what can get you in trouble."

All four Technology Coordinators discussed in depth the importance of the freshman technology essentials class. In addition to the course being a "Basics of the Google Education Suite," it establishes etiquette for how to communicate with teachers, individual students, student groups, and professionals. They all agreed that this has been the key to student behavior with the devices as they see significantly fewer discipline issues in regards to social media harassment and behavior once a student is a sophomore. Dante explained, "Much of what we see from the freshman when they start our class is your typical 8th grade behavior. It is amazing the

transformation as we work through the digital citizenship unit and how much of those behaviors disappear.”

Adult Understanding of Digital Citizenship. All four Technology Coordinators mentioned the struggle of instructors understanding of digital citizenship. This manifested itself in two areas. One was the ability of teachers to know what expectations they should have for students. Secondly, was what expectations they needed to be aware of for themselves. One fundamental shift Dante mentioned was the pedagogical change for teachers who are not used to teaching in a lab setting where students focus more on what is happening with their Chromebook versus watching an instructor. Students watching Netflix, messaging each other students, or the lookup or sharing of inappropriate material are only a few of the activities that were mentioned through the interviews. While off task behavior in the classroom is not new to teachers, the medium in which students were doing so was making it difficult for a classroom teacher to adjust to this new normal. All four Technology Coordinators mentioned presentations that they had done during staff meetings to outline the expectations of what students could do with the tools they learned in the tech essentials course and the distractions students were using in preference over school work.

Technology Coordinators also developed professional development opportunities in regards to adult digital citizenship. With the 1:1 Chromebook Initiative and the push to use the Google Apps for Education Suite there were many concerns that were adult-centered. Many of these issues revolved around the sharing or lack of sharing information with students. The issues ranged from the mildly annoying where students clicked on a link but didn't have permission to the violation of privacy laws when a document was shared that had students' personal information included. Additionally, there were other confidentiality issues with student access

to teacher accounts due to shared passwords or Chromebooks not being logged out of. All four agreed that none of the issues were done with ill intent but rather a lack of knowledge of what the Chromebook and the tools associated with them could do. This became more evident when tied back to digital citizenship for students as many of the distractible features were built into the education apps. One example given by Nico was the chat feature that is built into the doc. Used correctly, it allows collaborators to communicate before changes are made to a document. Unfortunately, teachers would use a shared doc to deliver instruction and rather than the focus being on a lecture, students were off task in a conversation that many times led to bullying or harassment. Another issue with the chat feature also arose with test documents that were shared and students sharing answers with one another. The solution was easy in that the chat feature could be turned off for documents but this was a feature that many instructors didn't know existed much less how to not allow it.

Pace of Technology Changes. Technology continues to change and evolve at a rapid pace leaving both teachers and students increasingly under greater pressure to incorporate the technology their students are most familiar with. This pressure was mentioned by all four of the Technology Coordinators and best described by Nico stating, "I think there is a lot of pressure for teachers at times to incorporate technology into their class. Sometimes that is good but other times it adds to the fatigue teachers feel about all the different educational movements that are going on. It's not that they are bad, it's just a lot for some to take in." Technology that is embedded seamlessly into a clear pedagogy can undoubtedly have a considerable impact but each day brings new and improved hardware, software, apps, and more. Dante pointed to Google specifically in that they don't release versions of their apps, they just make improvements. Teachers who are just learning the nuances of a particular app may want to give

up when the process they learned is suddenly changed and is now perceived to be more difficult. This is especially true for instructors who fall into the late adopter or struggler group. Walter explained that this group was already a difficult one to reach and changes in technology can be an additional roadblock.

Conclusion

The purpose of this transcendental phenomenological study was to explore the necessary leadership characteristics and the professional development technology coordinators provide to help teachers utilize these new technology tools. Four Technology Coordinators were interviewed about their role and their opinions of the success and failures of the 1:1 Chromebook program. Themes were then organized based on their similarities into three overarching themes: Shared Vision of Technology use among all Stakeholders, Importance of Digital Citizenship, and Differentiated Professional Development.

Each of the Technology Coordinators were selected for their position based on their prior experience working with students and adults in helping them understand and use technology. Each in their own way, they worked at the site or district level to build a shared vision for the 1:1 Chromebook program. School size, infrastructure capabilities, and their ability to help teachers connect how they teach with the use of a Chromebook all played a large role in the amount of success they saw in terms of implementation. Digital Citizenship also played a key role. Not only in helping students avoid the dangers of what can happen on the internet but also in educating adults about what to look out for as they have students use computers in class and learn what not to do themselves as they are online more and sharing more information. Finally, creating a differentiated and personalized professional development plan was a key factor. Building relationships and curriculum for instructors that caters to where they are as technology

learners was key to establishing engagement in pedagogy integrating new technology. More important was the idea of attempting to do this in an informal setting, setting foundational technology expectations for all teachers and ensuring that there is follow up from Technology Coordinators after the initial training. The next chapter provides explanations for the findings, their significance, and suggestions of how the results can be useful to stakeholders.

CHAPTER V

CONCLUSION

Policymakers and educators view 1:1 Chromebook programs as an approach to instruction that can prepare students for college success. The move toward successful integration of Chromebooks as a tool means teachers must alter pedagogical practices to leverage the technology to enhance classroom learning. While there is research that shows current 1:1 programs have demonstrated both positive and negative results whether students achieve more when they are given a device to use at school and at home, there is not extensive research on what professional development (both planning and implementing) and effective leadership is needed by site technology coordinators in order to effectively implement the 1:1 use of Chromebooks (Medlin, 2016; Williams & Larwin, 2016).

As technology continues to evolve, Technology Coordinators need to be prepared to lead their schools through this journey. The rate at which districts across the country implement 1:1 initiatives continues to rise. The goal of this research was to identify themes that can be a blueprint for others as they begin down this path. The Technology Coordinators in this study are pioneers in this new 1:1 world who have been able to identify and address many of the challenges that come with 1:1 implementation.

State and federal education policy makers continue to add expectations for secondary students, the achievement gap continues to widen for students who lack access to resources that reflect demanding standards, and new technical and pedagogical methods are needed. This fact drove the study and the researcher's desire to determine the technology coordinators' perceptions of 1:1 technology training approaches. The central question of the study was:

How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship influence the implementation of 1:1 of Chromebooks and their use?

This researcher also addressed the following sub-questions:

How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?

How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

Vygotsky's (1968) and Piaget's (1978) theories of cognitive development were used as the framework for this study as they argued that individualized education encourages students to construct their learning more successfully rather than receiving information given passively as Skinner (Gagne, 1995) argued through operant conditioning. Learning must be meaningful, personalized and specific to the individual in order to stimulate the greatest intrinsic motivation for students (Walshaw, 2017) and teacher-learners as well (Shabani, 2016).

This study also used the technological, pedagogical and content knowledge (TPACK) model (Mishra & Koehler, 2009) that emphasizes the importance of the combination of pedagogy, content, and technology in the classroom. The TPACK framework integrates a technological component into Shulman's (1986) theory of teacher education that emphasized not only teaching content and pedagogy as two separate entities but rather focuses on the integration of the two. TPACK then adds technology as the third element and includes the integration of

technology within each of the other two areas (TCK, TPK, and PCK) as well as integration of all three at once. Additionally, the study used the International Society for Technology in Education (ISTE) Standards for Administrators (ISTE Standards–A). These standards break down the knowledge and skills that administrators need to be successful leaders in terms of technology. The standards are grouped into five domains: visionary leadership, digital age learning culture, excellence in professional practice, systematic improvement, and digital citizenship.

Finally, a review of literature demonstrated four common themes for successful 1:1 Chromebook implementation.: communication, delegated leadership, collaboration, and professional development. These key elements were used to design and guide this study. Qualitative data was gathered through interviews conducted to gain the perspective of site technology coordinators who are taking on this initiative and creating professional development to support it. Understanding the perceptions and attitudes of the core group of technology coordinators was seen as a critical piece in learning the leadership skills needed to for successful implementation. Data was analyzed through the lens of Vygotsky's (1978) and Piaget's (1968) cognitive development model, the TPACK framework, ISTE standards for administrators, and the four themes of successful 1:1 Chromebook integration.

A transcendental phenomenological methodology was used to obtain the perceptions of four Technology Coordinators through in-person, semi-structured interviews. Technology Coordinators interviewed worked at four high schools and had anywhere from five to 20 years of experience as Technology Coordinators at their respective high schools. After the interviews were transcribed, they were then sent to the Technology Coordinator's for checking. Data analysis followed Moustakas' (1994) three-step process: Epoche, Transcendental Phenomenological Reduction, and Imaginative Variation. These steps were used to minimize

biases the researcher had and/or the researcher's personal experiences so that the experiences of participants were best realized (Creswell, 2007; Merriam; 2009; Moustakas, 1994).

The researcher highlighted 15 emergent sub themes to better understand the Technology Coordinator leadership capacity in regards to the ISTE standards and provide support for individual teachers within the TPACK framework. These themes were arranged into three central themes, with the sub-themes used throughout all but one which became a central theme itself. They included: (1) Shared Vision of Technology use among all Stakeholders; (2) Importance of Digital Citizenship; and (3) Differentiated Professional Development. This chapter includes an interpretation of the data as it depicts the three emergent themes. Moreover, the chapter discusses implications the research has and offers recommendations for action and further study.

Interpretation of Findings

Technology Coordinators viewed their experiences with 1:1 Chromebook implementations as mostly positive. Technology Coordinators believed the 1:1 Chromebook program allowed students better access to curriculum and resources. All Technology coordinators agreed that the 1:1 Chromebook program had fundamentally changed their way they approached their position.

Relationships were a common theme mentioned by all Technology Coordinators when discussing the way to build professional development plans as well as the importance of differentiating instruction for teachers of varied ability levels. The majority of Technology Coordinators viewed innovators on their campus as key people to assist in the further development of the coordination of technology and pedagogy in the classroom. The majority of Technology Coordinators also claimed that they struggled to make significant progress with

strugglers at their school but continually looked for opportunities to do so. All Technology Coordinators appreciated the vision developing process put in place by the district, they had varied levels of success in implementing the vision at their sites. They all commented on the level of success being related to the size of the school where they worked. Technology Coordinators also mentioned the lack of infrastructure as a struggle when 1:1 Chromebook implementation first began in the district. They describe the experience of teachers as one of frustration and creating more work for them rather than a time savings. Despite these barriers, the Technology Coordinators felt that they were able to overcome them, and they all described their current experience as something they couldn't see their school not doing today. The following subsections describe the interpretation of findings as they relate to the research questions.

How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship influence the implementation of 1:1 of Chromebooks and their use?

Visionary Leadership. Based on the interviews of the four Technology Coordinators visionary leadership was a critical component for successful 1:1 Chromebook implementation. They all referred to the Technology Think Tank that the district office had put together as the way a common vision was developed. They also felt strongly that at the beginning this process, staff would create a vision that would create a campus that would be proficient in implementing, assessing and supporting best practice for equitable teaching and learning. Technology Coordinators reported mixed results in their ability to lead the site in sharing this vision despite

the involvement of stakeholders at the site in developing it. Success was determined to be in relation to the size of the school with the smaller schools sharing the developed vision more readily.

Digital age learning culture. In addition to describing a shared vision as a critical component, building a digital learning culture was seen as equally critical. Technology Coordinators thought that the relationships that built with their staff, regardless of their technology ability level, was important. Technology Coordinators thought their role was to be approachable, flexible, and as helpful as possible. Additionally, they worked with district personnel and innovators on campus to discover new ways to integrate technology into the classroom. These developments were then taken by the Technology Coordinators and systematized so that they could be accessed by all teachers.

Moreover, Technology Coordinators reported that the development of technology expectations was key to creating a digital culture of teachers. The Technology Think Tank recommended a series of minimum expectations for all teachers to meet. Technology Coordinators felt this approach set the stage for them to work with teachers to meet these expectations and to see ways to enhance their teaching practices with technology.

Excellence in professional practice and systemic improvement. All Technology Coordinators felt they had an obligation to not only model effective use of technology but to thoroughly understand what technology integration looked like so they could articulate it to their teachers. They expressed concern about implementing this practice when dealing many different areas of content that they were unfamiliar with.

Digital citizenship. Technology Coordinators expressed that digital citizenship was an important topic during the implementation of the 1:1 Chromebook program. They also agreed that it continues to be relevant today. They viewed digital citizenship in two different ways: one from the perspective of the teachers and the other from the side of students. Teaching with 1:1 Chromebooks is essentially a computer lab setting. Many teachers are not used to this type of environment. The Technology Coordinators reported the need to provide professional development for teachers on how to monitor and work with students in this new environment giving them tips and tools on what to look out for.

Technology Coordinators also expressed concern for students' digital citizenship as well. 1:1 Chromebooks put a device in a student's hand at all times. The increased unsupervised time was a concern for each of them and the need to educate students on the long-term effects that a poor decision can have. The freshman technology course curriculum was seen as a key element for students in this regard.

How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?

Technology Coordinators cited several aspects of their experiences with the 1:1 Chromebook implementation that impacted its success. The extra professional support and individual attention they gave instructors helped them succeed in their classes. Technology Coordinators viewed their roles as creating an ongoing process to integrate 1:1 Chromebooks into the classroom to help students have better access the content. Additionally, they saw their role as one that helped teachers assimilate Chromebooks into their pedagogy so that students could better access the curriculum both inside and outside the classroom.

How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

Data suggested that a concerted effort was made by the Technology Coordinators to focus attention on the positive aspects of the 1:1 Chromebook program including a positive framing of the possibilities the devices could provide. Findings indicate that many teachers interpreted having Chromebooks in their classroom as an effective tool to enhance what they did in the classroom. Furthermore, findings indicated that Chromebooks may also act as an effective tool for changing pedagogical methods in order to connect with more students. Given the findings that teachers experienced a wide range of needs when it came to the way Chromebooks would be implemented, the data suggest that Technology Coordinators find ways to promote a differentiated method of professional development. Findings also indicated that technology coordinators did just that, taking on an individual and informal approach to each teacher's needs so they could maximize the awareness of opportunities possible with what was already present in their classrooms. In this way, Technology Coordinators could help heighten teachers' awareness of possibilities and help promote positive perceptions for teachers for the 1:1 Chromebook program.

Implications

The results of this phenomenological study are useful for the individual teachers as well as school and district leaders who are considering a 1:1 Chromebook program. The results are also meaningful for other Technology Coordinators and other technology school leaders interested in improving the way the 1:1 Chromebooks are used within their schools. Findings from the data provide a way to better describe the lived experiences of 1:1 Chromebook

implementation through the eyes of the Technology Coordinator's involved in the study. The limited number of Technology Coordinators along with the phenomenological nature of the study limit generalizing these results to all 1:1 Chromebook high schools, the shared nature of the emergent themes discussed in the data analysis suggest that the data provides a beneficial start to learning more about 1:1 Chromebooks implementation in the high school setting.

ISTE. High schools stand to benefit from this research directly through an increased awareness of the successes and areas of improvement seen by participating Technology Coordinators. Given the findings that all Technology Coordinators saw a connection between the use of Chromebooks in the classroom and the amount they believed in the shared vision, it stands to reason that building a shared vision at a site would be a key component to work on prior to the distribution of devices to students. Technology Coordinators listed several successful practices to build a successful shared vision. These are practices that could yield positive implications for 1:1 Chromebook implementation. Implications for Technology Coordinators or other school and site leaders follow in terms of building a critical mass of teachers interested in pursuing a more in depth use of 1:1 Chromebooks in the classroom and increasing the level of engagement there as well.

Four Themes. The findings from the data of the current study dovetail with recent 1:1 Chromebook implementation literature regarding the four common themes among the literature reviewed (Bocconi, Kampylis, & Punie, 2013; Janssen & Phillipson, 2015; Keane & Keane, 2017; Nash, 2009; Swallow, 2015; Towndrow & Vallance, 2013) and has recommendations for Technology Coordinators who seek to implement a 1:1 program at their site or throughout schools in their district. If Technology Coordinators were able to create an environment of communication, delegated leadership, collaboration, and professional development that led to the

aforementioned positive effects, it would follow that the use of 1:1 Chromebooks would increase in classrooms. The implications of increased use of 1:1 Chromebooks through use of the environment described above could benefit student engagement, increase the level of rigor in the classroom and ultimately increase student achievement.

TPACK. In a larger context, the study has implications for district level leaders seeking ways to implement a 1:1 Chromebook program. In considering the potential organizational benefits of the coordination of technology, content knowledge and pedagogy within the classroom differentiated and informal professional development could play a significant role in helping Technology Coordinators develop higher levels of 1:1 Chromebook implementation. Connecting this potential to recent literature, Harris and Hoffer (2016) argued that it was important for those planning professional development to meet teachers where they were in terms of a skillset in these three areas and that using the TPACK framework could connect additional initiatives directly to the 1:1 Chromebook implementation. In this respect, it would behoove Technology Coordinators and district leaders to educate themselves on how they can better support teachers in using 1:1 Chromebooks to enhance the classroom experience for students. They must then work to create a personalized learning system for each teacher's needs. Taking the position that teachers can learn side by side with students in constructing how technology can enhance their classroom fits the constructivist framework used in this study.

Recommendations

1:1 Chromebook initiatives continue to roll out in schools and districts across the country. Interviews of Technology Coordinators were conducted and themes were generated to address what leadership skills and professional development is needed for successful implementation.

This research fills a gap that was present in the research and provides recommendations based on the results for further examination.

Recommendation #1 - Expand the study to include more schools and districts

Since this study employed a small sample size, the findings may not necessarily be generalized to the broad range of Technology Coordinators implementing a 1:1 Chromebook program. Technology Coordinators in other districts may have different perceptions regarding their experiences with Chromebooks based on different leadership models in different districts as well as the different racial and socio-economic factors that exist at other schools. As a result, the researcher recommends that this study be expanded or duplicated to include other Technology Coordinator experiences. This is especially true in regards to the area of school size. The schools with a smaller population were found to have a higher level of fidelity with their implementation than the larger schools. While some researcher agree (Wu, Hsu, & Hwang, 2008), further studies could explore the reasons.

Recommendation #2 - Narrow the research to focus on the necessary preparation work done prior to beginning 1:1 Chromebook implementation

This study could also be narrowed to exploring the necessary steps needed to prepare for the implementation of a 1:1 Chromebook program. Technology Coordinators in this study reported on their experiences during the 1:1 Chromebook implementation. Further studies limited to investigating the experiences of Technology Coordinators and district personnel preparation efforts prior to implementation may yield different findings. A focus on this preparation could yield valuable information to keep schools and districts from having similar issues as seen in the district that was studied here.

Recommendation #3 - Comparison study between socio-economically disadvantaged students at schools with a 1:1 Chromebook program versus those without

Another area of exploration that would add to the literature would be a comparison of the experiences of socio-economically disadvantaged students who attend high schools that have a 1:1 Chromebook program with socio-economically disadvantaged students who attend high schools that do not. The study at hand added to the body of literature by focusing on the leadership characteristics needed for implementation. However, limited studies exist that compare the experiences of students who have had access to a 1:1 Chromebook program with those who have not. Existing studies have revealed no correlation between 1:1 Chromebook and increased student achievement on state test scores (Miller, 2017). This type of study could help educators and policymakers determine the value this program has on a group of students who typically underperform compared to their peers.

Recommendation #4 - Explore the perceptions of teachers who work at schools with a 1:1 Chromebook program and what would have improved their implementation experience

This study brought to the forefront some obstacles to 1:1 Chromebook implementation faced by Technology Coordinators at the high schools when supporting teachers to implement the devices in their classrooms. Changes in technology can be a barrier for teachers who lack a growth mindset and are resistant. This in turn affects student achievement (Chiarelli, 2018). Further research involving the perceptions of the teachers themselves during the 1:1 Chromebook implementation is recommended. Exploring the views of teachers would provide researchers, policymakers, and educators with a greater understanding of the barriers that they face. This awareness could help in the creation and quicker implementation of 1:1 Chromebook implementation with teachers.

Recommendation #5 - Identify factors that contribute to the success of informal professional development in regards to technology integration in the classroom

Further research can also focus on understanding the higher rate of success with informal professional development in regards to technology integration in the classroom. This study examined the methods of professional development that Technology Coordinators used and found a higher rate of success using informal methods.

Recent research into professional development agrees that the informal approach is one that needs to be examined further (Evans, 2019). Additional research may discover more specific methods or factors that contribute to this success. Understanding the challenges of creating this positive environment may promote a faster and more widely spread implementation of 1:1 Chromebooks at schools that start this process and may assist policymakers and educators in enacting policies and designing programs around this methodology.

Conclusion

Summarizing learning, Vygotsky (1968) and Piaget (1978) suggested that learning is done best when a student constructs their own reality. 1:1 Chromebooks programs are being implemented throughout the country with the idea that students and teachers can use devices to employ this type of learning. The ISTE framework for administrators outlines a leadership framework for school Technology Coordinators in all aspects of technology leadership. The purpose of this this qualitative case study was to document the relationship between a high school technology coordinator's understanding of the technological pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the impact of these capacities on classroom instruction and student achievement.

The Technology Coordinators who participated in the study described their experiences of the implementation of the 1:1 Chromebook program at their respective sites and the district as a whole. Technology Coordinators reported a consensus on the importance of teaching digital citizenship to adults and students, creating a professional development plan that involves differentiated and personalized instruction, as well as the importance of building a shared vision and level of expectations in the area of digital age learning. Through varied levels of success, the Technology Coordinator's realized the importance of a shared vision at the site and district level along with the need for a systematic process of improvement.

The research conducted provided many implications for schools and districts that are starting to implement a 1:1 Chromebook program. The concepts include the importance of district leadership, site leadership, professional development, school communication, and more. Recommendations for further research are to not only expand the research to study the pre-planning of implementation and examine more schools and districts who have been involved in an 1:1 Chromebook implementation but also to dive deeper into specifics of the nuances of other issues within the school. This includes looking at the experience of teachers, socio-economically disadvantaged students within a 1:1 Chromebook program, and the effect of personalized informal professional development as it relates to digital age learning. The use of technology in education is an ever-changing process. Understanding these changes and the fundamentals of leadership necessary to fully utilize this technology is essential to the success of districts, schools, and most importantly, students.

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Appendix A

Study Invitation

September 2018

Dear Technology Coordinator:

If you are not the Technology Coordinator at your school, please provide me the name of that individual so I may contact them. As a doctoral student completing his dissertation study through the University of New England, I am inviting you to ***participate in an interview to discuss the process, development, and implementation of professional development for your 1:1 Chromebook program.*** As a Technology Coordinator, you have significant leadership experience and knowledge of working with instructors with a variety of ability levels. This study focuses primarily on how you are creating and implementing professional development opportunities for this wide range of teachers. By completing this interview, you are providing a valuable contribution to the research around 1:1 Chromebook programs.

Research Questions: : How does the technology leadership capacity of a school's technology coordinator as defined by the ISTE Standards for Administrators in the domains of 1) visionary leadership, 2) digital age learning culture, 3) excellence in professional practice, 4) systemic improvement, and 5) digital citizenship influence the implementation of 1:1 of Chromebooks and their use?

- How do Technology Coordinators at four district high schools establish, enact, and sustain professional support for individual teachers adopting 1:1 Chromebooks in their classrooms?
- How do site Technology Coordinators structure professional development in the areas of technological pedagogical content knowledge (TPACK) to create a successful implementation of a 1:1 Chromebook program?

Study's Purpose: The purpose of this qualitative case study is to understand the relationship between a high school technology coordinator's understanding of the technological pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the impact of these capacities on classroom instruction and student achievement. The findings will inform and educate programs for other high schools who are implementing their own 1:1 Chromebook program as a guide toward effective use of these devices.

Procedures: Your participation in this research study is completely voluntary. The study includes an interview, possible follow-up phone interview, and collecting of

artifacts/items/resources from your school. The study will run from October 2018 to December 2018, with results/findings published by January 2019. Upon your request, I can send you a copy of your individual completed interview transcript and interview notes, as well as a copy of the completed dissertation. I do not foresee this study presenting any risks or hardship on you, other than the time to invest in it. However, your time invested will contribute to the immense anticipated benefits of collecting this data to share with other programs for the deaf. Together, we can create a better tomorrow for our students.

Confidentiality: Your identity will be protected throughout the study and thereafter. Only I, the researcher, will have access to your information. Follow-up verbal/signed and written reports and discussions will identify you only as a number (i.e. Participant #2). Your name and school location will not be shared with anyone else. Your confidentiality will be protected in compliance with the University of New England's research with human participants' policies and procedures.

Compensation: No monetary or non-monetary compensation will be provided for your input or time.

Questions: If you have any questions or concerns regarding this study and your participation, you may contact me, the researcher, via e-mail at jcactionmedia@gmail.com or jcutts@une.edu, or via my home phone personal line at 916-705-2015. You also may contact Dr. Michelle Collay at the University of New England at mcollay@une.edu or by phone at 207-602-2010.

Once you agree to the consent form, I will contact you to schedule an interview. Thank you for your valuable insights and willingness to participate in this research study. Your contribution not only supports my dissertation study, but also future reforms in 1:1 Chromebook programs.

Sincerely,

Justin Cutts, Doctoral Student
University of New England's Transformative Leadership Program

Appendix B

**UNIVERSITY OF NEW ENGLAND
CONSENT FOR PARTICIPATION IN RESEARCH**

Project Title: Leadership Skills and Professional Development for Successful 1:1 Implementation

Principal Investigator(s): Justin Cutts

Introduction:

- Please read this form. You may also request that the form is read to you. The purpose of this form is to give you information about this research study, and if you choose to participate, document that choice.
- You are encouraged to ask any questions that you may have about this study, now, during or after the project is complete. You can take as much time as you need to decide whether or not you want to participate. Your participation is voluntary.

Why is this research study being done?

The purpose of this qualitative case study is to understand the relationship between a high school technology coordinator's understanding of the technological pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the impact of these capacities on classroom instruction and student achievement. The findings will inform and educate programs for other high schools who are implementing their own 1:1 Chromebook program as a guide toward effective use of these devices.

Who will be in this study?

Technology Coordinators from Pheidippides County high schools.

What will I be asked to do?

Participants will be asked to participate in a 45-60 minute interview with questions about the leadership skills used and the professional development they developed in regards to the 1:1 Chromebook initiative.

What are the possible risks of taking part in this study?

N/A

What are the possible benefits of taking part in this study?

The benefits to subjects rely in the current themes as they will get the results of the final report when published.

What will it cost me?

N/A

How will my privacy be protected?

Numbers will be assigned to each technology coordinator and school so that no identifying information will be reported that would allow others to identify what data came from individual schools.

How will my data be kept confidential?

All data is stored on a secure Google Drive.

What are my rights as a research participant?

- Your participation is voluntary. Your decision to participate will have no impact on your current or future relations with the University.
- Your decision to participate will not affect your relationship with Pheidippides Union High School District.
- You may skip or refuse to answer any question for any reason.
- If you choose not to participate there is no penalty to you and you will not lose any benefits that you are otherwise entitled to receive.
- You are free to withdraw from this research study at any time, for any reason.
 - If you choose to withdraw from the research there will be no penalty to you and you will not lose any benefits that you are otherwise entitled to receive.
- You will be informed of any significant findings developed during the course of the research that may affect your willingness to participate in the research.
- If you sustain an injury while participating in this study, your participation may be ended.

What other options do I have?

- You may choose not to participate.

Whom may I contact with questions?

- The researchers conducting this study are Justin Cutts
 - For more information regarding this study, please contact Justin Cutts (jcutts@une.edu)
- If you choose to participate in this research study and believe you may have suffered a research related injury, please contact Michelle Collay (mcollay@une.edu)
- If you have any questions or concerns about your rights as a research subject, you may call Mary Bachman DeSilva, Sc.D., Chair of the UNE Institutional Review Board at (207) 221-4567 or irb@une.edu.

Will I receive a copy of this consent form?

- You will be given a copy of this consent form.
-

Participant's Statement

I understand the above description of this research and the risks and benefits associated with my participation as a research subject. I agree to take part in the research and do so voluntarily.

Participant's signature or

Date

Legally authorized representative

Printed name

Researcher's Statement

The participant named above had sufficient time to consider the information, had an opportunity to ask questions, and voluntarily agreed to be in this study.

Researcher's signature

Date

Printed name

Appendix C
Interview Protocol

Introduction: I am a doctoral student through the University of New England. I am studying what the relationship is between a high school technology coordinators technological pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the impact of these capacities on classroom instruction and student achievement. Your input will be valuable for improving 1:1 Chromebook implementation and professional development for teachers in high schools. I will ask you a series of questions and then allow time for more comments and questions from you at the end.

Demographic Information (If not already collected through the survey response; otherwise, verify responses to warm-up the conversation.):

What is your name? _____ (will be kept anonymous)

School? _____ (will be kept anonymous)

Phone Number? _____

Email? _____

Job Title? _____

Approximately how many students attend your school? _____

What is your gender? ___ Female ___ Male

Which age range are you in? ___ 20-29 years old, ___ 30-39 years old, ___ 40-49 years old, ___ 50-59 years old, ___ 60+ years old

What is your race/ethnicity? ___ Caucasian/White, ___ African American/Black, ___ Hispanic, ___ Biracial, ___ Other

What is your native language, first language? ___ Bilingual (ASL/English), ___ ASL, ___ English, ___ Other (comment: _____)

Four Themes & Constructivism

Research identifies six types of technology adopters in schools (show chart and explain as needed). Explain, how you personalize learning for each group?

In what ways do you communicate differently with each group?

In what ways do you promote collaboration with each group?

TPACK

In what ways do you formally and or informally determine the content, pedagogical, and technology capacity of teachers at your site?

In what ways do you coordinate an instructors content knowledge with the technology professional development that you are trying to implement?

In what ways do you coordinate an instructors pedagogical knowledge with the technology professional development that you are trying to coordinate?

Are there ways that you deliberately develop professional learning opportunities with content, pedagogy, and technology in mind at the same time? How do you do this with content that is outside your subject area?

ISTE

What role does the idea of equity or inclusion play in the development of your technology professional development (Use specific sub groups relevant to each site)?

In what ways do you engage members of the staff in sharing a vision for how to use technology in the classroom?

What evidence do you see that members of the staff share this vision?

In what ways do you empower other teachers on staff to use technology to enrich learning? What have been your areas of focus since implementation? How have these areas changed since the beginning of the Chromebook program?

What type of professional development system have you created on campus to support teachers in their learning?

How do you stay connected with what is new in the world of technology especially as it relates to Chromebooks and their use in the classroom?

Thank you for your time and for sharing with me about your program. This information contributes to the understanding of current practices and how we can improve them for the future. Please feel free to contact me at any time with any questions or comments. You are welcome to review the dissertation before and after its completed submission.

Appendix D

School Resource / Artifact Documentation

Introduction: I am a doctoral student through the University of New England. I am studying what the relationship is between a high school technology coordinators technological pedagogical content knowledge (TPACK) and their technology leadership capacities as defined by the International Society for Technology Education (ISTE) Standards for Administrators and the impact of these capacities on classroom instruction and student achievement. Your input will be valuable for improving 1:1 Chromebook implementation and professional development for teachers in high schools. I am collecting examples of these technologies to create richer descriptions and accurate impressions of current practices. Then, I want to allow you time for comments and questions at the end.

1. Show me examples of how your program customizes professional development to meet the needs of the six types of technology adopters in schools.
2. Show me examples of your communication to each group?
3. Show me examples of how you promoted collaboration homogeneously and heterogeneously amongst the six different groups?
4. Show me examples of how you have tried to motivate each of the different groups to buy into the professional development?
5. Show me examples of any formal assessment of teachers level of capacity with their content area, pedagogical ability, and technology ability.
6. Show me examples of how you coordinate with curriculum leaders on your site to develop professional learning opportunities to incorporate content, pedagogy, and technology.
7. Show me examples of how your professional development works to create an equitable experience for your identified sub groups?
8. Show me examples of how your teachers share your vision of how to use technology in the classroom.

9. Show me examples of how have a shared leadership model with teachers using technology in the classroom?
10. Show me examples of the system of professional development that has been created at your site.

Thank you for your time and for sharing resources with me from your program. This information contributes to the understanding of current practices and how we can improve them for the future. Feel free to contact me at any time with any questions or comments. You are welcome to review the dissertation before and after its completed submission.