TEACHER PERCEPTIONS OF A TECHNOLOGY-BASED GOOGLE CLASSROOM

A Dissertation

Presented to

The Faculty of the Education Department

Carson-Newman University

In Partial Fulfillment

Of the

Requirements for the Degree

Doctor of Education

By

Tracy D. Ballew

March 2017

CARSON-NEWMAN
UNIVERSITY

Dissertation Approval

Student Name/ CNU ID: Tracy Ballew, CN # 0278514

Dissertation Title: Teacher Perceptions of a Technology-Based Google Classroom

This dissertation has been approved and accepted by the faculty of the Education Department, Carson-Newman University, in partial fulfillment of the requirements for the degree, Doctor of Education.

Dissertation Committee:

Signatures: (Print and Sign)

Dissertation Chair
Dr. Patricia G. Murphree

Dr. Patricia G. Murphree

Methodologist Member
Dr. Christopher Shon

Dr. Chris Shon

Content Member
Dr. Andrew Jackson

Dr. Andrew A. Jackson

Approved by the Dissertation Committee Date: 3/15/2017

Abstract

As technology becomes more pervasive in society, it is also more frequently integrated into schools across the globe. Many schools are moving toward a one-to-one computer to student ratio. These integrations have been studied for more than two decades; however, both qualitative and quantitative studies have reported mixed effects of the use of technology in the classroom. As schools endeavor to prepare students for life after graduation and as a means to stay abreast with current trends, student computer usage is at an all-time high. However, the role of facilitator and keeper of classroom technology still lies in the hands of the teacher. As teachers attempt to integrate technology and its uses in their classrooms, they also carry with them their preconceived notions and prior experiences with technology. Therefore, the teachers' perceptions can possibly affect the efficacy of the implementation. This study analyzed a school district's Google Classroom integration which included three different grade levels across the district. Teacher perceptions regarding the Google Classroom and its effects on the classroom were measured via a voluntary Likert scale survey. The study aimed to determine whether teachers' years of experience, grade level assignment, and subject matter influenced their perceptions of the technology-based Google Classroom. The chi-square test of independence was utilized to determine if a relationship was found between teachers' perceptions and the three variables. In fact, all three variables were found to have a relationship with teacher perceptions, thereby causing the null hypotheses to be rejected. The teacher participants' responses regarding Google Classroom were found to be dependent upon their years of experience, grade level assignment, and subject matter.

Acknowledgments and Dedication

I am truly blessed to have been surrounded by such wonderful people. In His infinite wisdom, the Lord knew exactly what I needed and when, and I am grateful for His ever-guiding and protecting hand. My husband Hans has championed this cause, even during the overwhelming times of career advancements and family life. Hans, you were my catalyst, and I will always consider you my beloved. As we journeyed this road together, we have proven even more our eternal bond for which I am so grateful. There is no place in the world I would rather be than with you. My two children, Elijah and Maddy, my great blessings, you have watched us as we completed our various graduate degrees, culminating here. I am hopeful that our quest for learning is something now intrinsic in you, as well as appreciative of the sacrifices you have made in order for this to be fulfilled. I love you all.

I would also like to thank my committee, Drs. Murphree, Shon, and Jackson for their guidance and encouragement. I appreciate your insight and feedback, as I asked my numerous questions. You helped straighten the way for my study, as I knew only what I wanted to research at the outset and not necessarily how to get there. On an informal level and beyond the committee, I appreciate you, Andy (Dr. Jackson) for tolerating my walking into your classroom with many questions and sending you various pieces of the puzzle for your perusal and input. You were a calming and supportive friend and colleague.

Finally, I would like to dedicate this to my late mother, Martha Harman, who was the epitome of a Christian wife, mother, and woman. May I continue to grow in His grace, as you exemplified.

Table of Contents

Chapter 1: Introduction

The integration of technology is not a necessarily new trend in the field of education. For decades, schools around the world have attempted to implement technology plans which aim to supply more frequent use of technology to their students. The assumption is that technology can not only improve day-to-day classroom instruction but also that its interactive nature and necessity for life after school have lasting effects on the students (Iftakhar, 2016; Keppler, Weiler, & Maas, 2014). Implementation strategies, as well as technological advances, are as varied as they are vast (Penuel, 2006). Many schools began with simple computer labs stationed within the school building for periodic use scheduled by the teachers (Bebell & Kay, 2010; Sell, Cornelius-White, Chang, McLean, & Roworth, 2012). Then, as the personal computing trend continued to grow and as an effort to stay abreast of the 21st century skills, schools began purchasing even more computers and other technologies with the goal of a much more pervasive student usage (Bebell & Kay, 2010; Bebell & O'Dwyer, 2010; Keppler et al., 2014).

As the depth and breadth of the capabilities of technology continue to grow each year, most K-12 schools are attempting more and more to include technological resources as much as possible. Common in educational settings today are desktop computer labs, wireless internet, and even laptop computers for student use (Sell et al., 2012). With many culminating assessments and college and career readiness tools available only online, educators understand the importance of preparing students for a society rich in technology usage (Keppler et al., 2014). To this end, many schools across the globe have undertaken a particularly pervasive and practical technological integration: one-to-one laptop computers for their students as a means to improve and enhance their learning (Weston & Bain, 2010).

However, implementation of such large-scale programs differs greatly among schools, as do the intended results (Penuel, 2006; Weston & Bain, 2010). These larger implementations created issues to be discussed such as necessary prior training for teachers, best implementation and support strategies, and technology's overall effectiveness in the classroom (Spires, Oliver, & Corn, 2012; Wright & Wislon, 2011). Although district personnel and funding options typically define the timing and quantity of such programs, the disconnect remains between purchasing the tools and implementing the tools (Anthony, 2012; Bebell & O'Dwyer, 2010). In fact, teachers remain in the classroom with student users and represent the facilitators of such implementations (Ertmer, 2005; Gorder, 2008; Shin, Han, & Kim, 2014). To this end, many researchers declare professional development for teachers paramount to successful integration of classroom technology (Bebell & O'Dwyer, 2010; Owen, Farsaii, Knezek, & Christensen, 2006; Spire et al., 2012). Furthermore, with teachers as the primary implementers of new computer-based classrooms, both the technological savviness of the teacher and his/her views toward a technology-centered classroom must be examined (Anthony, 2012; Ertmer, 2005; Gorder, 2008; Ismail, 2015; Kayalar, 2016).

Statement of the Problem

Schools across the nation have spent billions in purchasing and implementing technology as a means to improve student learning and student technology skills (Bebell & Kay, 2010; Sell et al., 2012). In addition to the claims that computers can increase achievement for students in school, some researchers proposed that utilizing technology in K-12 classrooms better prepares students for a technology-rich society after their secondary education (Ismail, 2015; Kayalar, 2016; Keppler et al., 2014). However, even after hundreds of studies aimed at validating these claims, the time, money, and effort spent in piloting new technological roll-outs has yet to

produce conclusive results that name specific technological integrations as the catalyst for improved achievement and utilization (Penuel, 2006; Weston & Bain, 2010). Results of effectiveness vary as widely as do implementation procedures. Clearly, successful integration of computers in the classroom requires more than simply purchasing the technology (Anthony, 2012; Bebell & O'Dwyer, 2010).

One apparent factor remains constant: the most pivotal role in teaching students to use technology to enhance their learning still lies predominantly with the classroom teacher (Cox, 2013; Ertmer, 2005; Kayalar, 2016; Osler, Hollowell, & Nichols, 2012). Moreover, despite professional developments created to alleviate some of the angst among teachers who find themselves as the sole facilitator of a technology-based classroom, many teachers amid a one-to-one technology program still report pressures and barriers to successful integration (Anthony, 2012; Gulek & Demirtas, 2005; MacKinnon, 2002; Wright & Wislon, 2011). To many teachers, technology use is a part of everyday life, but to others, it still remains a learning-process wherein they learn with the students they teach. In addition to various teaching styles and personalities, teacher perceptions of technology stand to have a large effect on their ability to integrate well the computers and technologies that have been entrusted them. Because classroom teachers are still the chief originator for the students' use of computer-based learning and because prior experiences and interactions of the teacher shape their views of these technologies, perceptions may distort or enhance the implementation process, thereby possibly skewing any quantitative effect data designed to prove the program's efficacy (Ertmer, 2005; Ismail, 2015; Kayalar, 2016; Gorder, 2008).

Significance of the Study

The purpose of this study was to assess teacher perceptions regarding implementing a technology-based course in the classroom via Google Classroom and Google Chromebooks. Several researchers held that technology integration in the classroom can not only familiarize students with the utilization of technology that will be necessary after schooling but that it can also improve student engagement within lessons (Bakia, Means, Gallagher, Chen, & Jones, 2009; Sauers & McLeod, 2012; Storz & Hoffman, 2013). Many researchers argued that increasing student engagement can be seen as a precursor to increasing performance (Bebell & Kay, 2010; Owen et al., 2006). This study aimed to quantify teachers' perceived effects of an ongoing pilot program reaching grade levels 4, 7, and 10 and spanning various subjects to determine if any correlations exist between their perceptions and the independent variables, years of experience, school assignment, and subject matter.

The results of this study added to the existing body of research regarding technology implementation in the classroom which is relatively new and underdeveloped (Penuel, 2006; Sell et al., 2012). Furthermore, this study attempted to establish certain demographic identifiers which may pre-dispose teachers to either a positive or negative perception of the integration of technology. Such identification enhanced the current research regarding the use of technology in education by affording a view of what possible barriers should be mitigated prior to introducing an integration program.

Theoretical Framework

This study utilized a theoretical framework based largely on social constructivism which attributes much of human beings' learning to their surroundings and experiences. John Dewey, as well as Lev Vygotsky assumed that humans' learning is inseparable from their experience

(Liu & Chen, 2010). With this in mind, technology integration and the very hands-on nature of it rest primarily on the constructivists' theory in its original form (Schcolnik, Kol, & Abarbanel, 2006). In other words, as students engage in the technology-centered classroom, they learn from the interactivity and experiences therein. Students learn more, constructivists hold, when they are able to construct the information for themselves, rather than hearing and repeating it. Knowledge, therefore, is not transferred to them via a professor or teacher, but rather through an experiential involvement in the acquisition of knowledge (Lin & Jou, 2013). Various forms of this theory have been utilized in education, with the focus of the classroom morphing from teacher-centered to student-centered learning (Ouyang & Stanley, 2014).

Technology-based classrooms and their integration serve the parameters of constructivism well in more ways than simply the hands-on, student-centered approach. In fact, the teachers and/or facilitators of said technology also engage in constructivism as they pull on prior knowledge and experience (Liu & Chen, 2010). Due to the constructivist belief that prior interactions shape future learning, the very facilitators of technology integration, teachers, also bring a myriad of experiential lessons to the computer-based classroom atmosphere (Schcolnik et al., 2006). Furthermore, due to drawing understanding and conclusions based upon prior environments and interactions, teachers may, even inadvertently, apply prior experiences and attitudes toward a particular subject (e.g., technology) to the present setting. These beliefs and attitudes held by the teacher then form a viewpoint which decides how the teacher feels, implements, and utilizes certain in-class methods. In short, an understanding of constructivism and how humans create meaning from prior experiences, in turn, shapes the way teachers perceive and implement new tools such as technology in their classrooms (Lin & Jou, 2013; Ouyang & Stanley, 2014).

Research Question

The research question that framed this study:

Do teachers' years of experience, grade level assignment, and subject matter influence teacher perceptions of a technology-based Google Classroom?

Limitations and Delimitations

There were several factors that limited this study. Due to the nature of Likert scales, the possibility of the error of generosity and the error of severity were both possible limitations (Ary, Jacobs, Sorenson, & Walker, 2013). In other words, raters may have rated overly positively or negatively. Furthermore, the schools in the pilot program were new to the technology-based classroom initiative; therefore, answers may have reflected the bias of inexperience. The study was limited to using Google Chromebooks as the technology about which the teachers were surveyed. The study was limited to technology in the classroom because the Chromebooks were not allowed to go home, preventing an exploration of a true one-to-one initiative. Finally, not all sample participants completed the survey, as the survey was not mandatory.

This study delimited the participants to only those teachers instructing grades fourth, seventh, and tenth, as those grades were selected specifically for the pilot roll-out by the school district for the year the study was conducted. Also, the timing and data of the study was delimited to one survey given in the middle of the year. It is possible that perceptions could have changed from the beginning of the year and could have also changed by the end of the year. The study was delimited to one school district for convenience sampling, but the same study could yield different results in another school district.

Null Hypotheses

Specific hypotheses for this study included:

$H_{01.}$ Teachers' years of experience does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

$H_{02.}$ Teachers' school assignment does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

$H_{03.}$ Teachers' subject matter does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

Definition of Terms

Google Chromebook. A laptop computer which relies on internet access, allowing users to save and run cloud-based applications (*Google.com,* 2016)

Laptop computer. A small, portable computer with all components in one device which performs normal computing tasks (*Merriam-Webster.com*, 2015)

One-to-one (1:1) laptop initiative. A program which provides laptops or other small computing devices to students for use both in and out of school (Bebell & Kay, 2010)

Perceptions. Views, feelings, awareness, and/or observations noticed by the participants regarding the study's context (*Merriam-Webster.com*, 2015)

Pilot program. Initial, experimental implementation of a new device as a means of testing suitability or efficacy (Bakia et al., 2009)

Technology Integration. The intentional use of various types of technology in a setting such as schools and classrooms (Bakia et al., 2009)

Assumptions

It was assumed that all teachers surveyed had been using the Google Chromebooks in their technology-based classroom at the time of the survey. Likewise, the responses were assumed to accurately reflect the perceptions of the teachers at that moment in the initiative. Teacher demographics were also assumed as accurate since the information was provided by the individual teachers. Lastly, it was assumed that the teachers were utilizing the technology in the manner reflected by the survey prompts. For instance, if the prompt questioned whether technology had an effect on assessment scores, it was assumed that the teacher used the technology for assessment.

Organization of the Document

Chapter 1 introduces technological integration in an educational setting. The researcher then states the problem and gives the significance for the study. The researcher discusses the theoretical framework for the study and supplies the research questions, hypotheses, definition of terms, limitations and delimitations, and assumptions of the study. Chapter 2 is a review of literature exploring the use of technology in schools. The researcher also discusses literature related to years of experience, school assignment, and subject matter in the review of literature. Chapter 3 explains the methodology of the study. The chapter details the data collection procedures, data analysis, population and sampling, and how the study was conducted. Chapter 4 discusses the specific findings of the study. Chapter 5 specifies the conclusions of the study, the value of the findings, the generalizability of the research, and the recommendations for further research.

Chapter 2: Literature Review

Everyday use of technology in education was once a novel idea, available only to an elite few. However, in the past few decades and with the introduction of laptop computers, this has changed drastically. In fact, in many schools across the globe, students utilize laptop computers or hand held tablets daily as a part of the class curriculum, and many of these computing devices go home with the students at the end of the school day (Bebell & Kay, 2010). Since the nineties, school districts have spent billions of dollars attempting to keep up with the personal computing craze and the belief that engaging students in the use of technology in the classroom promotes learning and preparedness for life in the 21st century (Bebell & Kay, 2010; Sell, Cornelius-White, Chang, McLean, & Roworth, 2012). In some programs, various corporations and even the federal government have supplied the funds or the tools for the sole purpose of integrating personal computing in the classroom (Gulek & Demirtas, 2005; Penuel, 2006). Although technology-based classroom initiatives are prevalent, the research behind them remains mixed in its description of the best way to integrate personal laptops or tablets into the classroom and the definitive effects on student learning (Bebell & Kay, 2010; Goodwin, 2011).

History of One-to-one

One of the first districts to introduce a one-to-one initiative, Beaufort County in South Carolina began with a pilot program by supplying sixth graders with laptops in 1994 and then widened their initiative to all middle school grades by 2000 (Gulek & Demirtas, 2005). Similar programs were implemented in 1996 in New York and California. In 2000, Maine began one of the largest student laptop pilot programs which then spread to include 36,000 laptops across the state for middle school students and teachers (Gulek & Demirtas, 2005). School leaders in Virginia and Texas then quickly followed the trend by providing laptops for all secondary

students (Penuel, 2006). Microsoft also partnered with the laptop initiative by supplying student laptops for 52 schools across the country in 1996 and then widening that scope to 800 schools by the year 2000 (Gulek & Demirtas, 2005). Bebell and Kay (2010) of Boston College reported that by the 2003-2004 school years, approximately 4% of the nation's schools had implemented a one-to-one laptop initiative. They estimated that this percentage grew to almost a quarter of the schools in the country by 2006 (Bebell & Kay, 2010). As part of the 2002 No Child Left Behind Act (NCLB), the federal government also began a student technology initiative in schools, allotting 3.4 billion dollars to the project's implementation in "high-need" schools (Bakia, Means, Gallagher, Chen, & Jones, 2009, p. vii). The number of laptop initiatives across the country still continues to rise, and with that, the ratio of students to laptops comes ever closer to one-to-one (Bebell & Kay, 2010).

21st Century Skills

Technology's influence and impact has continually expanded in the last three decades, especially prominent in business and communication. As technology and its influence grow, so do the voices calling for the same influx in the field of education. Business owners, government officials, and educational leaders all appear to agree that students must learn to use modern technology, including computers, in order to best prepare themselves for life after graduation. As a means to be considered global participants and/or competitors, researchers argued that students must utilize the very tools which connect nations (Keppler, Weiler, & Maas, 2014). To this end, schools have responded with integrations focused on answering business owners' assertion that workers who possess 21st Century skills can effectively utilize technology to research, learn, and connect globally (Ismail, 2015).

Likewise, Fethi Kayalar (2016) suggested that parents, teachers, and students demand technological integration into schools so that students may be equipped to do the following:

> Prepare themselves for their future careers, keep pace with the other students who have technology in their schools, have the chance to interact with their classmates, access to up-to-date information, become more active and engaged in the course, and utilize multiple types of resources online. (p. 18)

He asserted that education must now place more importance on students' personalized learning, rather than on teaching and that students can and should benefit from an education combined with modern technology (Kayalar, 2016). Similarly, Keppler et al. (2014) expanded upon this same view of the necessity of technology in schools by stating that even the, "students desire a technology-rich learning environment, [one] which provides them opportunities to explore, learn, and take responsibility for their progress" (p. 279). Shampa Iftakhar (2016) summed his research sentiments succinctly: "Teaching in the 21st century does mean teaching 21st generation. It means helping and monitoring the students to learn and implement 21st century skill[s]" (p. 17).

Students Today

Amid the growing trend of computers in the classroom, various justifications for their use have been made, some of which include increasing students' technological proficiency, improving academic performance, focusing on student-centered activities, allowing for use in and outside of the classroom, promoting collaborative learning, and preparing students for life after their K-12 education (Sell, Cornelius-White, Chang, McLean, & Roworth, 2012). However, few researchers cite an even more obvious matter as the very reason why students should learn via technology.

> Today's students, often called digital natives or the Net Generation, grow up with technology. Most of them have never known life without the Internet. They have spent their entire lives using computers, cell phones, and other digital media and have integrated technology into almost everything they do. It is obvious that technology is an integral part of their lives. To engage them in learning, there has been increased emphasis on the integration of technology into K–12 classrooms. (An & Reigeluth, 2011, p. 54)

Similarly, Hariadi, Dewiyani, and Sudarmaningtyas (2016) concur that students in school today, students considered part of Generation Z, have quite a different perspective on technology than those of previous generations mostly due to the pervasive nature of it. They claimed current students should be educated differently than their priors based upon their cultural knowledge of technology. They outlined certain characteristics of Generation Z students and what they are already capable of doing:

> (1) Comfortable and very dependent on technology, it [sic] is because Generation Z grew surrounded by technology, (2) multitasking with a variety of online products and sophisticated technology equipments, and appreciate simplicity and the interactive design, (3) have a higher social responsibility with the amount of information that can be accessed online, (4) always connect, communicate through social networks, cross country and culture that indirectly affect their thought and decision-making process. (Hariadi et al., 2016, p. 60)

The researchers continued by calling for a less conventional view of schooling and a more integrative "learning process" which no longer relies solely on "faculty-centered learning", calling it inappropriate and outdated (Hariadi et al., 2016, p. 60). They suggested an entirely new model for education, one which builds upon what students of today already know and do.

Web and Cloud-Based Learning Applications

The rise in distance learning at the university level during the past decade has prompted technology companies to incorporate and even create new ways for teachers and students to communicate regarding education online (Lin & Jou, 2013). From this rise sprang many new programs and web-based tools which aim to diminish the separation of distance learning and make the online experience more integrative. Applications and programs designed to facilitate connectivity and communication are considered Web 2.0 applications (Lin & Jou, 2013). Of these, universities and online public schools have utilized SkyDrive, Evernote, Dropbox, Blackboard, and Google Apps (Lin & Jou, 2013). The newest of these, according to Lin and Jou, must be user-firendly and support a learning environment through connectivity and participation. As distance or online students log in to the class from their homes and complete interactive assignments, research, and discussions via a web-based application, the programs allow more freedom in their learning process and are considered examples of student-centered learning (Knowlton, 2000). In other words, the teacher or professor may assign tasks and texts, but the responsibility to retain and apply the knowledge found in the texts lies with the student. The student then submits coursework via the online portal for teacher assessment (Knowlton, 2000).

Cloud-based learning portals offer an even more interactive approach because they allow for multiple participants and collaboration across the Internet. Cloud-based programs do not require storage on a student's hard-drive (Shinsky & Stevens, 2011; Vickers, Field, & Melakoski, 2015). The sole purpose of cloud-based programs is that the information is stored and shared via the Internet and not reliant on one single technological machine (Vickers et al., 2015). Many students who now attend online classes come to the new online portals with previous knowledge of cloud-based apps due to cell phone usage. Sharing via a cloud-based app allows

mulitple participants to work on a live document rather than having to save it and send it (Hariadi et al., 2016; Vickers et al., 2015). Participants can edit, revise, add, and delete portions. This particularly novel notion lends itself well to the roles of teaching and learning whereas professors and teachers may supply immediate feedback for the students regarding their work, as well as suggest certain revisions and/or further research (Vickers et al., 2015).

Google, a front-runner in the field of technology, has created and honed a series of cloud-based applications designed specifically for teachers and students (Hariadi et al., 2016; Shinsky & Stevens, 2011). According to Shinsky and Stevens (2011), Google has created a complete suite of applications that not only align but enhance teaching and learning in the 21st century, based solely on Web 2.0 abilities:

> Google Apps for Education is a suite of cloud-based applications that Google provides free to educational institutions. Unlike traditional computer programs which must be installed on the user's computer, cloud-based applications are available to users from any Internet-connected computer using a browser. Because the software and data exist on the web, cloud-based programs can run seamlessly from a wide variety of computers and mobile devices.
>
> The Google Apps for Education cloud-based suite includes e-mail, a calendar, website creation software, and a set of office applications for word processing, spreadsheets, drawings, slideshows, and surveys. The online workspace also can function as a file locker, where a variety of documents can be uploaded for storage and sharing. Since these applications and the associated work files reside in the cloud, we had access to our work from any Internet-connected computer, providing maximum flexibility to our team. Also, several of the tools include real-time collaboration capabilities, with integrated chat

> and the ability for multiple team members to work on a product simultaneously. This appealed to us as busy professionals. (Shinsky & Stevens, 2011, p. 205)

Moreover, Shinsky and Stevens (2011) held that due to the progressive nature of online learning, faculty and school personnel are in a distinct position to impact the learning of students by utilizing such interactive tools.

Responses to such innovations in both technology and the classroom have been reported as not only positive but timely. One particular study at a Taiwanese university interviewed both students and teachers to determine their views regarding web and cloud-based implementations in the classroom (Lin & Jou, 2013). The study concluded that not only was the learning of the students supported by the technological integration while in school but that it also improved support after class via connectivity. Furthermore, the web-based support was reported to help overcome limitations of class time interactions between teacher and student, thereby strengthening the learning atmosphere of the course by way of online interaction (Lin & Jou, 2013).

In a similar experimental study, Suwantarathrip and Wichadee (2014) "compared writing abilities of students who collaborated on writing assignments using Google Docs with those working in groups in a face-to-face classroom" (p. 148). One group utilized the Google app by collaborating outside of normal school hours as the other group used group writing time in class. The researchers not only found positive student attitudes toward the web-based collaboration but also found that students in the collaborative web-based group scored significantly higher on the various writing activities than did the face-to-face group (Suwantarathip & Wichadee, 2014). The researchers credited the format of Google Docs: "Since Google Docs is stored online, students can work at school and at home from any computer with an Internet connection, and

they are more likely to revisit their work if they know someone else will be commenting on it" (Suwantarathip & Wichadee, 2014, p. 149). The researchers concluded that the live, "real time" collaboration gave the students confidence and support necessary for improving their writing (Suwantarathip & Wichadee, 2014, p. 149).

Hariadi et al. (2016) furthered touted the benefits of utilizing online collaborative applications with students by commending the Google Apps for Education. "The benefits of GAfE include (1) stay [sic] connected wherever, uniting students and lecturers quickly without space and time constraints, (2) ease of managing tasks, grades and courses, and (3) unlimited learning sources, for both students and lecturers" (p. 61). From their study, they concluded that 79% of their participants considered the applications easy to use, and 82% of the lecturers believed the applications enhanced their instruction (Hariadi et al., 2016). The researchers recommend further incorporation of these applications into classrooms, as they may improve the educational process and are quite suitable for this generation of students (Hariadi et al., 2016).

Google Classroom takes the web-based applications, namely the Google Apps for Education, one step further for education by compiling them in to one virtual, interactive platform designed for students as an online classroom. In his study, "Google Classroom: What Works and How?", Shampa Iftakhar (2016) stated, "Google Classroom is meant to help teachers manage the creation and collection of student assignments in a paperless environment, basically leveraging the framework of Google Docs, Drive and other apps. Google classroom allows teachers to spend more time with their students and less time on the paperwork, and it is now even better" (Iftakhar, 2016, p. 12). His research recounted experiences from classrooms of various subjects who utilized the brand new Google Classroom in 2014. He asked various questions of his participants, all relating to the integration of the virtual classroom. Overall, his

participants reported positively regarding the integration as a way to promote "blended learning" with technology, notwithstanding a few possible integration hindrances (Iftakhar, 2016, p. 16). Most salient in his report were the possible benefits to students and teachers of Google Classroom. He itemized the benefits as follows:

- Google Classroom has the potential to streamline communication and workflow for students by providing a single access point to discussion threads and assigned work.
- Google Classroom can help students to keep their files more organized because all their work can be stored paperlessly in a single program.
- Faculty can more quickly identify which students may be struggling with their assignments due to the tracking mechanisms associated with assigned tasks.
- Grading processes can be simplified because of the grading features associated with student submissions. (Iftakhar, 2016, p. 16)

However, he cautioned that in order to fully observe the advantage of it, participants in a Google Classroom should hold an optimistic view of technology's integration into classroom instruction (Iftakhar, 2016).

Measured Achievement Effects of Integrations

Researchers offer numerous reasons and critiques as to why one-to-one student laptop programs studied receive varying performance results. Researchers from the Ozarks Educational Research Initiative contended in their meta-analysis of several studies that the discrepancy in actual quantitative output from studies may have been the studies themselves (Sell et al., 2012). In other words, some studies used systematic approaches while others non-systematic. Also notable, as Penuel (2006) hypothesized, not all implementations were designed and directed to solely increase academic achievement. Similarly, as other researchers also posited, each study's

population may have integrated the student laptops differently (Penuel, 2006; Sell et al., 2012; Weston & Bain, 2010). However, studies designed to measure gains in achievement deserve mention.

Maine's large-scale one-to-one middle school program yielded mixed quantitative results in all tested subjects except in the subject of writing which improved 3.44 points after five years (Goodwin, 2011). According to Keppler, Weiler, and Maas (2014), writing scores also improved in Littleton, Colorado. However, this one-to-one program had a specifically designed goal of improving student writing (Keppler et al., 2014). Gulek and Demirtas (2005) found that in Pleasantown, California achievement scores improved for laptop users in math subjects and English language arts (ELA), as well as improved grade point averages for users, after only one year of integration (Gulek & Demirtas, 2005). Likewise, science scores in an urban middle school rose significantly after implementation; however, the math scores showed no change (Dunleavy & Heinecke, 2007). Furthermore, Texas' Technology Immersion Program reported significant gains in middle school ELA scores but not in math (Bebell & Kay, 2010). Although the quantitative results of one-to-one laptop programs across the country offer mixed test-based achievement effects, other integration benefits coincided in the studies.

Perceived Outcomes of Integrations

Despite differing data regarding achievement measured through culminating tests, researchers do find several common benefits of a one-to-one laptop implementation. For instance, some studies of integration programs revealed that the main goal of implementation was the use of technology itself, not as a means to produce higher achievement scores (Sauers & McLeod, 2012). For instance, after a six-year implementation funded by the federal government's Enhancing Education through Technology (EETT) program, students who were

considered high-risk gained access to in-school technology at a rate comparable to those schools not considered high-risk (Bakia, Means, Gallagher, Chen, & Jones, 2009). The EETT required only that students who received computers meet literacy standards set by the state by the end of their eighth grade year. Assessing the adequate integration of the laptop computers was left up to the individual states, most of which required students to competently complete a technology course via the new computers. Not all of the schools receiving funds tracked the literacy data, but the schools which assessed the students' technology literacy had an 88% pass rate by 2007 (Bakia et al., 2009). Similarly, Gulek and Demirtas (2005) cited the ability to use technology with more flexibility and with deeper understanding as one of the most prominent benefits they found for student laptop users. Due simply to immediate and everyday access, schools in a Texas study reported student mastery of common technological tools such as word-processing, slide presentations, Internet searches, and more (Shapley et al., 2006).

Student response. One-to-one laptops' direct effect on student motivation served as another common theme among researchers. For instance, Dunleavy and Heinecke (2007) posited that laptops give immediate response to unanswered questions and, therefore, afford a deeper learning experience. Keppler, Weiler, and Maas (2014) found similar positive effects when they utilized student surveys in their study of the Littleton Public Schools. Student responses were largely favorable, crediting the laptops to simplifying lessons and homework such as essays (Keppler, Weiler, & Maas, 2014). Shapley et al. (2006) studied 44 middle schools in Texas' technology program. Of the schools involved, 22 were control schools, and 22 were one-to-one recipients. By way of student surveys, the researchers found that students' interest in school and overall satisfaction improved considerably as a result of the one-to-one implementation (Shapley et al., 2006).

Storz and Hoffman (2013) interviewed students in an initial one-to-one pilot program. Although mostly positive, some interviewed students admitted that everyday technology use in class can become repetitive. In this same school, one student lamented the overuse of presentation software as "boring" while another replied that she was "doing the same thing, just [now] on computers" (Storz & Hoffman, 2013, p. 9). Furthermore, students admit to spending time off-task with their laptops, playing games or chatting with peers; however, the observers did not note any more off-task behavior than is typical in middle school classrooms. Nevertheless, some students said they appreciated the ease with which they could contact the teacher with questions, even from home. One student stated that he believed he was receiving a "better education" (Storz & Hoffman, 2013, p. 9).

Teacher response. Bebell and Kay (2010) reported, after quantifying their survey results, that teachers in Massachusetts's one-to-one initiative overwhelmingly believed that the laptop program improved classroom teaching and learning. In fact, of the respondents, 83% believed that their students were more engaged in class and in their own learning as a result of the one-to-one initiative. The researchers summarized their findings from teacher surveys as, "Student engagement increased dramatically in response to the enhanced educational access and opportunities afforded by 1:1 computing through the pilot program" (Bebell & Kay, 2010, p. 3). In addition, 71% of teachers reported their students having improved motivation with the implementation of laptop usage. Engagement appeared to increase even more so with typically low achieving students. Teachers also noted a rise in students' ability to work independently (Bebell & Kay, 2010). In other studies, teachers touted enhanced communication with their students via email and teacher webpages (Spires, Oliver, & Corn, 2012; Storz & Hoffman, 2013). In one mid-western school that was studied during its pilot phase, teachers reported doing

less lecturing and more project-based learning (Storz & Hoffman, 2013). This is concurrent with findings of Gulek and Demirtas (2005) and Owen, Farsaii, Knezek, and Christensen (2006) who found that teachers of one-to-one classrooms rely less on direct instruction and more on inquiry-based assignments where the students must actively seek out information.

Some of the teachers interviewed expressed concerns about off task behavior, while others mentioned the environment of a one-to-one classroom to be quieter and less disruptive (Storz & Hoffman, 2013). Several teachers mentioned the ability for students to online chat with their peers while in class. Of those, some found it a great hindrance, while others likened it to passing notes in class (Storz & Hoffman, 2013). The researchers of the study in Irving, Texas recounted that some teachers had a difficult time switching to a one-to-one based classroom because of the "locus of control" being dramatically shifted from teacher to students (Owen, Farsaii, Knezek, & Christensen, 2006, p. 15). Several studies and teachers mentioned the necessity for preparedness (Bebell & O'Dwyer, 2010; Owen et al., 2006; Spires et al., 2012). In other words, teachers must not only understand the content material well but also how to deliver and assess the content via laptop use (Weston & Bain, 2010). This reflects similar sentiments echoed by teachers desiring more training before and during the implementation process (Owen, Farsaii, Knezek, & Christensen, 2006; Spires, Oliver, & Corn, 2012; Storz & Hoffman, 2013).

Role of Teachers

Implementing large amounts of technology into schools for student use is not a simple task; in fact, it is one that requires much planning, funding, and supporting. However, the role of facilitator and implementer of technology consistently falls to one position: the teacher. The teachers in the classroom with the students play the most pivotal role in their integrated learning, most likely due to simple proximity. In his study regarding experienced teachers integrating

technology into their classrooms, Jerad Cox (2013) explained the roles of both teachers and technology.

> Teachers and technology are widely considered as the two of the most impactful educational resources in schools today. Teachers are education's biggest resource and its biggest expense; they balance the needs of individual students and whole classrooms, parental and administrative whims, and personal and district ideologies. Technology, meanwhile, is at its very center an idea of change, a constantly moving matrix of hardware, software, and human interaction, and is expanding at a rate never before seen in education or history. The ever-changing relationship between teachers and the technology they integrate in their classroom has become a vital function of the education system. (p. 209)

The pivotal role of teachers and their influence on the integration of classroom computers and technology was echoed by Bebell and Kay (2010) and Shapley et al. (2010) who found that teachers were the sole determiner of when and how students use technology for learning purposes. From their study of the Berkshire Wireless Learning Initiative, they concluded that it was "impossible to overstate the power of individual teacher in the success or failure of 1:1 computing" (Bebell & Kay, 2010, p. 47). Moreover, due to teachers being tasked with lesson planning, educational researching, teaching and applying technological skills, and allowing time for technology's usage in class, teachers were deemed the "gatekeepers" of their students' introduction and usage of technology (Bebell & Kay, 2010, p. 16).

Teachers' beliefs. Technology integration remains a complex system void of one standardized procedural implementation. However, researchers have noted that in light of their pivotal role in the integration, teachers' views and perceptions regarding technology as a whole

have the susceptibility to influence the integration (Anthony, 2012; Cox, 2013; Tsai, 2015). In other words, whether a teacher is adept at not only using technology but also teaching it may influence the implementations' success or failure (Gorder, 2008; Ismail, 2015; Kayalar, 2016). Ester Aflalo (2014) differentiated between the commonly interchanged terms *beliefs* and *perceptions* of teachers. He held that teachers' beliefs toward technology are shaped by prior perceptions of it, perceptions which are generally attributed to previous interactions (or lack of interactions) with computers and technology. Furthermore, he insisted that knowledge of technology, including its uses and its integrations, does not necessarily overcome the teachers' beliefs toward it. As teachers discover the possibilities of a technology-based classroom, they will utilize it more, and this usage influences their view of it (Aflalo, 2014). Other researchers echoed this same connection between teachers' attitudes and perceptions of technology influencing their implementation of it (Shin, Han, & Kim, 2014). In fact, teachers' knowledge of their subject and/or of technology did not necessarily equate to successful integration. The most prominent factor affecting integrations was found to be teachers' beliefs and perceptions of technology in general (Aflalo, 2014; Ertmer, 2005; Shin et al., 2014).

Years of Experience. Experience in any career affords the veteran worker with an understanding of the tasks at hand and ability to handle various situations that arise. In education, tenured teachers often serve as mentors to newly hired teachers, teaching them procedures and modeling management techniques; however, novice teachers who have been in their preservice educational courses more recently than the experienced teachers may also bring with them tips and tools of the trade that are more representative of the current culture in which they teach. To this end, Wright and Wilson (2011) studied teacher education programs and their instruction regarding technology. They suggested that all preservice teacher courses now not only integrate

technology for the aspiring teachers but also that they supply the novices with how best to integrate technology in their own future classrooms. Furthermore, they found that the more access and usage preservice teachers have with technology, the more likely they are to utilize it more often in class (Wright & Wislon, 2011).

Studies also depicted mixed results when attempting to identify which teachers were better suited at integrating technology in the classroom. Some researchers found that experienced teachers incorporated technology more, attributing this to their comfort level with other things such as curriculum and procedures (Gilakjani, 2013). Other studies, however, proposed that senior teachers, or those with the most experience, are more reticent to integrate technology because of their lack of technological skills.

> It is reasonable that a senior teacher with insufficient technology skills considers subject content knowledge and learning effectiveness as the key factors in whether to implement technology integration. However, poor technology management is likely to reduce the willingness of senior teachers to implement innovative teaching technology. (Tsai, 2015, p. 158)

Still, Tsai (2015) found this reticence to be mutable, indicating that when the tenured teachers, although admittedly more concerned with subject matter than integration, perceived positive outcomes from the technology-based classroom, their perceptions and willingness to adapt also improved. Jerad Cox (2013) reported that although several studies have sought to determine a link between "age-based generational attitudes of teachers towards technology and their professional technology use", the biggest factor influencing classroom technology integration is the possibility of it to create "more problems and fewer solutions for teachers" (p. 210). He

furthered that this may be especially true with experienced teachers who have long-established routines and goals (Cox, 2013).

Subject matter. In studies of one-to-one technology implementations across the nation, school subjects and the influence of technology on the subject material has been varied. Although the integration of technology certainly improves students' skills and ability to utilize technologies, the research does not clearly define which subjects are best suited for a technology-based classroom. English language arts showed the most promise in that researchers of several studies found that collaborative writing activities and the interconnectivity of a technology-based classroom supplied students with support for their writing, which translated into increased writing scores (Bebell & O'Dwyer, 2010; Suwantarathip & Wichadee, 2014). Bebell and Kay (2010) found that "7th graders participating in the computer writing study wrote both longer and more highly scored open response essays when using their laptops than students responding to the same prompt using traditional paper and pencil" (p. 45). Furthermore, the school administration of the pilot program proclaimed that students were far more willing to write and revise "second drafts when using a computer" (Bebell & Kay, 2010, p. 30). In their study of the Texas Technology Immersion Pilot, Shapley et al. (2006) found statistically significant gains in the subject of science but not the other four subjects studied. Donna and Miller (2013) held that in addition to aligning with the National Science Education Standards, integrating technology into the science classroom can also "help support collaborative inquiry within science education and can help model how scientists use technology" (p. 2). Also notable, Gulek and Demirtas (2005) found positive quantitative gains in several subjects but only after the initial year of the one-to-one pilot program:

> The baseline data for all measures showed that there was no statistically significant difference in English language arts, mathematics, writing, and overall grade point average achievement between laptop and non-laptop students prior to enrollment in the program. However, laptop students showed significantly higher achievement in nearly all measures after one year in the program. (Gulek & Demirtas, 2005, p. 3)

Because of the mixed results of research studies, Dunleavy and Heinecke (2007) called for more studies to be aimed at identifying which subjects lend themselves best to a technology-based classroom. Furthermore, they contended that their "results draw attention to the need to focus on differences of the impact of technology in different content areas. The application of technology to different content areas may have differential effects" (Dunleavy & Heinecke, 2007, p. 18).

Grade level assignment. In the effort to incorporate computer technology into schools, many initial pilot programs began with either middle or high school students, but now programs span the K-12 spectrum. Bebell and Kay (2010) studied one particularly well-known pilot program in Massachusetts aimed entirely at middle school students:

> The overall aim of the pilot program was to determine the efficacy of a one-to-one laptop initiative in transforming teaching and learning in a traditional middle school setting. Specifically, the targeted outcomes of the BWLI included: enhancing student achievement, improving student engagement, improving classroom management, enhancing students' capabilities to conduct independent research and collaborate with their peers, as well as creating fundamental changes in teaching strategies and curriculum delivery. (Bebell & Kay, 2010, p. 7)

From the study, the researchers found considerable gains after a year of implementation. One researcher found that although one-to-one technology implementations are becoming prevalent

in elementary grades, a ratio of one-to-two computing is more than sufficient with younger students (Larkin, 2011). Through interviews and data collection, Larkin found that students ages 11-13 worked well in pairs, while still learning the technological skills one would learn from a one-to-one classroom. He concluded that, for this age of students, "one-to-two computing is preferable to one-to-one computing to achieve a balance between productivity, student engagement, social activity, and individualized learning" (Larkin, 2011, p. 101). Finally, Gorder (2008) commented on teachers' use of technology-based classrooms in the secondary setting: "The only significant difference in technology integration and uses is based on grade level. Teachers in grades 9-12 tend to integrate and use technology more than teachers in grades K-5 or grades 6-8" (Gorder, 2008, p. 73). In all, she found that many demographic differences of teachers have no bearing on technology's integration, with the exception of grade levels. "Teachers at the various grade levels differ in how technology is integrated and used in the classroom" (Gorder, 2008, p. 74).

Conclusion

Although one-to-one initiatives are increasing in popularity and prevalence, the study of such settings remains relatively new and unestablished. However, most researchers agreed on this: the laptop revolution has endless possibilities for the education of students and even communities. In fact, Owen, Farsaii, Knezek, & Christensen (2006) found in a study of Irving Independent School District that students were enthusiastically taking their laptops home and teaching other family members how to use them too. Bebell and O'Dwyer (2010) cautioned that any implementation of technology must be seen as a supplement to solid, previously established teaching practices, not a standalone fix. Furthermore, the role that teachers play in technology's integration cannot be understated. Many researchers contended that the very attitudes and beliefs

that the classroom facilitators hold have the potential to largely influence and affect the integrations' successes or failures (Aflalo, 2014; Cox, 2013; Gilakjani, 2013; Kayalar, 2016; Ouyang & Stanley, 2014; Wright & Wislon, 2011). Several researchers call for deeper study into this initiative and its effects, holding that the unprecedented nature of technology leaves possibilities for an even greater educational reach (Penuel, 2006; Shapley et al., 2006; Weston & Bain, 2010). Finally, as Yun An recommended, "Further studies might test the generalizability of these results by examining K–12 teachers' beliefs, perceptions, barriers, and support needs in the context of creating technology-enhanced, learner-centered classrooms in different school districts, states, or countries" (p. 61).

Chapter 3: Methodology

Introduction

This study was designed as correlational research to determine if teacher years of experience, grade level assignment, and subject matter influence teacher perceptions of a technology-based Google Classroom. The researcher utilized the chi-square test separately for each independent variable. The chi-square test was used because "there is just one variable […] divided into any number of categories" (Tanner, Using Statistics to Make Educational Decisions, 2012, p. 333). The chi-square test is one of the most widely used tests of significance when dealing with nominal data (Ary D. , Jacobs, Sorenson, & Walker, 2014). Additionally, this test can be used with samples of various sizes, including small samples (Tanner, 2012). The independent variables in this study include teachers' years of experience, grade level assignment, and subject matter. Teacher perceptions represent the dependent variable.

Teacher participants reported their years of experience, counting only completed years. School years in the district studied begin in mid-August and end in early June. School assignments were separated into intermediate schools, K-8 schools, primary schools, middle schools, and high schools. Intermediate schools generally host grades 3-5. K-8 schools host kindergarten through 8th grade. Only one primary school was included because it is the only primary school in the district that hosts 4th grade. Any school hosting 10th grade was considered a high school, and any school hosting a 7th grade was considered a middle school, regardless of grade level infrastructure. Subject matter was categorized as (a) English language arts, (b) mathematics, (c) science, or (d) social studies. Likert scale survey responses gauged teacher perceptions regarding the technology-based Google Classroom.

Population and Sample

Due to a district-wide pilot program in grade levels fourth, seventh, and tenth, participants in the study included the teachers of those grade levels implementing the Google Classroom across the district. Due to the nature of the study and the pilot program, the sample was preselected based upon teacher assignment. The number of participants chosen to implement the Google Classroom included 136 teachers throughout the district, comprised of only those teachers assigned to the pilot grades at the time of the survey. Furthermore, not all participants responded to the survey, as the survey's completion was not mandatory. Teacher responses represented various grade-level assignments, subject matter, and years of experience.

The population of the study represented all teachers in the pre-K through 12th grade school system of the selected district. This population included teachers from eight K-8 schools, four primary schools (although only one serves students in 4th grade), three intermediate schools, four middle schools, five high schools, and other specialty schools that were not used in the study. In total, there are 28 schools in the school district. The population for this school district is 967 teachers. The school district serves approximately 15,000 students.

The accessible population for the study was delimited to fourth, seventh, and tenth grade teachers due to those grades being chosen as participants in the pilot program for Google Classroom utilizing Google Chromebooks. Therefore, the researcher used nonprobability sampling as the sampling technique. The researcher used convenience sampling as the sampling procedure because of the limited population and sample (Tanner, Using Statistics to Make Educational Decisions, 2012).

Description of Instruments

The instrument used for the correlational study was a Likert scale survey directly asking teachers to rate how strongly they agree or disagree with the prompts (Ary D. , Jacobs, Sorenson, & Walker, 2014). The prompts were created based upon reviewing the literature regarding implementing technology in the classroom, similar pilot programs, and teachers' perceptions regarding technology. Furthermore, the researcher field-tested the survey by asking various educators not included in the study to complete and comment on the survey, so as to remove any ambiguity or redundancies within the nine prompts. The survey also included demographic entries for years of experience, grade level assignment, and subject matter. The instrument used was a five point Likert scale ranging from (1) *Strongly Agree* to (5) *Strongly Disagree*. The survey was created and administered using the Google Forms questionnaire format which automatically collates data into a Google Sheets spreadsheet form as respondents submit their answers. Moreover, the Google Form format allowed the researcher to send the survey directly to the teachers' facilitator Chromebook.

Research Procedures and Time Period of the Study

Teacher perceptions of the technology-based Google Classroom served as the dependent variable. Teachers' years of experience, grade level assignment, and subject matter represented the independent variables. For the purposes of collecting quantitative data, the researcher used Likert scale surveys and made them available via district supplied email accounts to the teachers of classrooms included in the pilot program. These were coupled with communication to the teachers which gave instructions for completing the survey. Teachers of the participating grade levels were sent an email link to the Google Form survey on which they rated their perceptions regarding the implementation. In order to gather as many responses as possible within the

sample, the researcher sent follow-up emails to those participants who had not responded after a week. Furthermore, the researcher utilized the districts' email system to send reminder requests specifically to several pilot teachers who had not responded even after the second request.

Teachers' years of experience was categorized according to the following four groups: 0-5 years' experience, 6-15 years' experience, 16-25 years' experience, and more than 25 years' experience. The researcher categorized the grade level assignments of the teachers into fourth, seventh, and tenth grades. English language arts, mathematics, science, and social studies were the four categorized groups of subject matter. The time period for the study was the 2016-2017 school year. The survey was given in the middle of the school year. This time frame gave the teachers a full semester of experience with implementing the technology-based Google Classroom into their instruction classrooms while not adding to their end-of-year duties.

Data Analysis

The survey was designed to measure the participants' perceptions regarding the technological focus and instructional applicability of the Google Classroom. The survey listed nine prompts specific to various uses of the student Chromebooks and Google Classroom. Since the Likert scale was designed to measure attitudes and perceptions of participants, the survey supplied the participants with five options ranging from (1) *Strongly Agree* to (5) *Strongly Disagree* (Ary et al., 2014). The teacher responses automatically populated into a Google Sheet spreadsheet drawn from the Google Form survey. These were identified by prompt number and demographic information. In fact, the Google Form totaled percentages of the five Likert responses, including all respondents. Then, the data was transferred into Microsoft Excel and separated into the variable groups for the purposes of retaining anonymity of the teachers and conducting the statistical test.

The researcher also tallied the frequency of each of the five responses for each question to provide a view of the teacher perceptions. Next, the responses were categorized by the four years of experience groups, three grade level assignments, and four subject areas to gain a clearer picture of teacher perception in each of the school categories. In order to determine which responses were chosen most frequently, sums were totaled by each response and by each of the variable groups.

The chi-square test of independence was performed to determine if a relationship existed between the three teacher background variables and the teachers' perception of the technology-based Google Classroom. The chi-square test aimed to determine the relationships between teacher years of experience, grade level assignment, and subject matter on the teachers' perceptions of a technology-based Google Classroom. The chi square test compared expected frequencies with observed frequencies (Ary D. , Jacobs, Sorenson, & Walker, 2014). Each chi square test assumed that frequencies were distributed evenly among categories for each independent variable. The test of significance indicated to the researcher which variables had a statistically significant relationship at the .05 confidence interval with the dependent variable of teacher perception as measured by the Likert scale survey. A chi-square test was also run on the nine prompts within the variables to determine if the individual prompts had a significant relationship to the perceptions of that group.

This study met the assumptions of a chi square test (Ary et al., 2014). First, the observations were independent and the participants were chosen based on their grade level assignment due to the school district's implementation plan for Google Chromebooks. Secondly, the categories were mutually exclusive. Teachers could only choose one grade level assignment,

one years of experience category, and one subject level in the survey. Lastly, the independent variable data were recorded as frequencies for each category.

The level of significance for this study was set at .05 (Ary et al., 2014). The teachers' years of experience were divided into four categories supplying 3 as the degree of freedom. In order for the test of significance to reject the null hypothesis for teachers' years of experience, the x^2 value needed to equal 21.026 or greater. The grade level assignment information was divided into three categories, indicating the degree of freedom of 2. For the test of significance to reject the null hypothesis for school assignment, the x^2 value needed to equal 15.507 or greater. The subject matter was divided into four categories giving the degree of freedom of 3 again. For the test of significance to reject the null hypothesis for subject matter taught, the x^2 value needed to equal 21.026 or greater. These decision rules determined the level of significance of the relationship between teacher years of experience, school assignment, and subject matter, as well as gave a basis to reject the null hypotheses.

Chapter 4: Findings

The purpose of this study was to identify teachers' perceptions of the technology-based Google Classroom implementation and to determine if those perceptions were independent of the three chosen variables: years of experience, grade level assignment, and subject matter. In order to collect and compare responses, an electronic survey was created using Google Forms. The survey consisted of nine prompts to which the teachers could rate their agreement or disagreement via Likert scale (Ary D. , Jacobs, Sorenson, & Walker, 2014). The Google Form survey was sent to the teachers involved in the Google Classroom roll-out by way of their school district email address. Their first-hand account of the implementation of Google Classroom afforded the teachers a unique perspective of the technology's integration into the classroom. The responses to the survey were tabulated for frequency and then examined using the chi-squared test of independence. The analysis was in an effort to answer the research question which framed the study:

> Do teachers' years of experience, grade level assignment, and subject matter influence teacher perceptions of a technology-based Google Classroom?

Specific null hypotheses for this study included:

> $H_{01.}$ Teachers' years of experience does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.
>
> $H_{02.}$ Teachers' school assignment does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.
>
> $H_{03.}$ Teachers' subject matter does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

The results of these analyses, as well as other findings, are discussed in this chapter.

Selection of Participants

The accessible population included all teachers in the district who taught one of the three grade levels chosen for the Google Classroom roll-out, grades four, seven, and ten. All 136 teachers received the voluntary survey via their district email. Some responded after one request, while others responded after the second or third request. Twenty-nine of the roll-out teachers chose not to respond at all. Individual responses were kept confidential to ensure anonymity, and responses were only analyzed by groups.

Brief Summary of Survey Prompts and Responses

At the close of the survey, 107 responses had been collected. Each of the respondents answered nine different prompts regarding their utilization of the technology-based Google Classroom with their students. Teacher respondents were varied in many ways such as educational background, school placement, and teaching style. Furthermore, per the study's driving questions, the teachers were among three different grade levels, four subject areas, and four ranges of years of experience. Teacher respondents reported that 25 were tenth grade teachers, 43 were seventh grade teachers, and 39 were fourth grade teachers. The four subject areas represented in the survey were English language arts which included 43 teachers, math including 39 teachers, science comprising 13 teachers, and social studies totaling 12 teachers. Finally, teachers' years of experience ranges were grouped into four categories with 30 teachers in the 0-5 category, 40 in the 6-15 years, 28 in the 16-25 years category, and 9 in the 25 or more years category. The electronic Google Form used to collect the responses collated the group responses into pie graphs of percentages of each answer, not yet separated by the study's variables.

Prompt 1. *The technology-based Google Classroom has increased my productivity as a teacher (planning, grading, etc.).*

Of the 107 teachers who responded to the survey, more than half chose a positive response regarding their productivity within Google Classroom. In fact, 20.6% chose (1) *Strongly Agree,* and 34.6% chose (2) *Agree Somewhat*. Next, 31.8% of the teachers chose the response (3) *Neither Agree nor Disagree*. Only 11.2% chose (4) *Disagree Somewhat,* while only 1.9% of the teachers chose (5) *Strongly Disagree* to the prompt stating that Google Classroom increased teacher productivity.

Prompt 2. *The technology-based Google Classroom has increased my students' productivity.*

Regarding student productivity while using Google Classroom, the teachers' perceptions were again mainly positive. (1) *Strongly Agree* was chosen by 16.8% of the teachers in response to the second prompt. A 43.9% of the teachers chose 2 on the Likert scale for *Agree Somewhat,* and 24.3% of the teachers chose (3) *Neither Agree nor Disagree.* The fourth choice had 14% of the responses for (4) *Disagree Somewhat,* and only 1 response, .9%, was given for (5) *Strongly Disagree*.

Prompt 3. *With the technology-based Google Classroom, students have fewer missing assignments.*

The teachers' perceptions of missing student assignments while using Google Classroom returned responses close to the middle responses. *Strongly Agree* had 13.1%. Choices (2) *Agree Somewhat* and (4) *Disagree Somewhat* had the same number of teacher responses, compiling 18.7% each. The majority of responses were (3) *Neither Agree nor Disagree* at 43%. However, 6.5% of the teachers did choose (5) *Strongly Disagree*.

Prompt 4. *Students appear more engaged (asking questions, offering input, researching to find answers) in class when utilizing Google Classroom.*

The teachers' reported that they felt their students were more engaged in class when using Google Classroom. This was shown by 71% of teachers choosing to agree with the prompt: 27.1% of teachers chose (1) *Strongly Agree*, while 43.9% chose (2) *Agree Somewhat.* In the middle of the Likert scale, (3) *Neither Agree nor Disagree*, fell 19.6% of the responses. Only 9.3% selected the (4) *Disagree Somewhat* category. Finally, there were 0 responses in the (5) *Strongly Disagree* category.

Prompt 5. *Students perform better on assessments when utilizing the Google Classroom for test-taking.*

Teacher perceptions for student performance on assessments were distinctly undecided. (3) *Neither Agree nor Disagree* was chosen by 54.2% of the teachers. No teachers responded that they (1) *Strongly Agree*, and 25.2% chose (2) *Agree Somewhat*. For the disagree options, 15.9% of teachers chose (4) *Disagree Somewhat*, and 4.7% chose (5) *Strongly Disagree*.

Prompt 6. *Students write/create more thorough responses when utilizing the Google Classroom.*

Regarding improved student writing within Google Classroom, the teachers responded in every category. In fact, of the respondents, 9.3% of teachers responded that they (1) *Strongly Agree*. The same number of teachers chose (2) *Agree Somewhat* and (3) *Neither Agree nor Disagree* at 41 teachers each, or 38.3% for each category. In response to Prompt 6, 10.3% of the teachers chose the (4) *Disagree Somewhat* choice, while 3.7% chose (5) *Strongly Disagree*.

Prompt 7. *Utilizing the Chromebooks/Google Classroom saves me time in planning.*

The prompt regarding planning time for teachers within a Google Classroom elicited various responses. However, even with the varied responses, this prompt garnered more negative responses than most of the other prompts. (1) *Strongly Agree* was selected by 18.7% of the teachers. (2) *Agree Somewhat* was selected by 24.3%. The (3) *Neither Agree nor Disagree* response was chosen by 20.6% of teachers. Similar to option 2, 25.2% of the teachers chose (4) *Disagree Somewhat*, and 11.2% of teachers chose (5) *Strongly Disagree*.

Prompt 8. *Utilizing the Google Classroom improves the efficacy of my teaching (effectiveness or results of teaching).*

Teacher perceptions regarding their efficacy or effectiveness as a Google Classroom teacher were only somewhat positive. Only 8.4% of respondents chose (1) *Strongly Agree*, but 37.4% and 39.3% chose (2) *Agree Somewhat* and *Neither Agree nor Disagree,* respectively. The choice (4) *Disagree Somewhat* was chosen by 11.2%, and (5) *Strongly Disagree* was selected by 3.7% of the teachers.

Prompt 9. *Utilizing the Google Classroom improves student retention of the subject matter.*

Teacher responses denoting their perceptions regarding the use of Google Classroom improving the students' retention of the subject matter came back unclear, neither specifically positive nor negative. (1) *Strongly Agree* was chosen by 4.7% of teacher respondents. (2) *Agree Somewhat* was chosen by 40.2% of the teachers. Many teachers chose (3) *Neither Agree nor Disagree* to make up 49.5% of the responses. Only 4 teachers chose (4) *Disagree Somewhat* at 3.7%, and 2 teachers, or 1.9%, chose (5) *Strongly Disagree*.

Table 4.1

Percentage Summary of All Likert Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	20.6	34.6	31.8	11.2	1.9
2	16.8	43.9	24.3	14	0.9
3	13.1	18.7	43	18.7	6.5
4	27.1	43.9	19.6	9.3	0
5	0	25.2	54.2	15.9	4.7
6	9.3	38.3	38.3	10.3	3.7
7	18.7	24.3	20.6	25.2	11.2
8	8.4	37.4	39.3	11.2	3.7
9	4.7	40.2	49.5	3.7	1.9

Variable One: Teachers' Years of Experience

Teacher respondents held various years of teaching experience. For the purpose of the study, ranges of years were given as four different options from which teachers could choose. These were separated according to the following groups: 0-5 years' experience, 6-15 years, 16-25 years, and 25 years or more. Each respondent replied to the nine prompts with a 1-5 ranking of agreement via the Likert scale which was designed to measure attitudes the respondents have toward the technology-based Google Classroom (Ary D. , Jacobs, Sorenson, & Walker, 2014).

0-5 years of experience. The teachers in the range with the least experience chose the (2) *Agree Somewhat* response most frequently in Prompts 1, 2, 6, 8 and 9. However, in Prompt 3 and Prompt 5, these teachers chose (3) Neither Agree nor Disagree most often. To Prompt 4

regarding student engagement, teachers with 0-5 years of experience chose (1) *Strongly Agree* most frequently. However, to Prompt 7 regarding Google Classroom saving teacher planning time, the highest number of responses fell in the (4) *Disagree Somewhat* selection.

Table 4.2

0-5 Years Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	8	11	7	3	1
2	7	13	5	5	0
3	6	3	15	4	2
4	13	10	5	2	0
5	0	9	15	6	0
6	4	14	7	3	2
7	9	3	5	10	3
8	3	14	9	3	1
9	2	15	10	3	0

6-15 years of experience. The teachers with 6-15 years of experience composed the largest group. In this group, the selection (3) *Neither Agree nor Disagree* garnered the most responses in several of the prompts. This was true in Prompts 1, 3, 5, 8, and 9. Furthermore, two of the prompts, Prompt 6 and Prompt 7 both had an equal number of responses in the (2) *Agree Somewhat* and the (3) *Neither Agree nor Disagree* column. The other two prompts, Prompt 2 and Prompt 4 both had the highest number of responses within the (2) *Agree Somewhat* selection. As

shown in Table 4.3, this group had limited responses in both the (1) *Strongly Agree* and (5) *Strongly Disagree* choices.

Table 4.3

6-15 Years Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	9	13	14	4	0
2	6	17	11	6	0
3	3	11	15	7	4
4	9	19	8	4	0
5	0	5	25	7	3
6	4	15	15	4	2
7	8	11	11	6	4
8	3	14	18	4	1
9	2	13	23	1	1

16-25 years of experience. There were 28 teachers who responded that had between 16 and 25 years of experience. In response to the nine prompts, many teachers in this group responded with the (2) *Agree Somewhat* choice. In fact, five of the prompts, Prompts 1, 2, 4, 8, and 9 had the highest number of responses in that category. However, four of the prompts, Prompts 3, 5, 6, and 7 had the highest number of responses in the (3) *Neither Agree nor Disagree* category. Very few teachers in this group chose (4) *Disagree Somewhat* or (5) *Strongly Disagree*

to the prompts, with the exception of Prompt 7, the prompt regarding teacher planning time, which garnered nine responses in the (4) *Disagree Somewhat* category.

Table 4.5

16-25 Years Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	4	12	10	2	0
2	4	15	7	2	0
3	5	5	11	6	1
4	5	14	6	3	0
5	0	9	15	3	1
6	1	10	14	3	0
7	3	10	4	9	2
8	2	12	11	3	0
9	0	15	13	0	0

More than 25 years of experience. This was the smallest group by far with only nine respondents. Five of the prompts, Prompts 2, 3, 6, 8, and 9 had the largest number of responses in the (3) *Neither Agree nor Disagree* selection. However, Prompt 1 had equal number of responses in both (3) *Neither Agree nor Disagree* and (4) *Disagree Somewhat*. Prompts 4 and 5 had the most responses in the (2) *Agree Somewhat* selection. Notably, the 25 years of experience or more group is the only group to have a specific prompt, Prompt 7 regarding planning time, score highest in the (5) *Strongly Disagree* selection.

Table 4.6

More Than 25 Years Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	1	1	3	3	1
2	1	2	3	2	1
3	0	1	5	3	0
4	2	4	2	1	0
5	0	4	3	1	1
6	1	2	5	1	0
7	0	2	2	2	3
8	1	0	4	2	2
9	1	0	7	0	1

Years of Experience Chi-square Tests

Teacher responses to all nine prompts were first collated into one chart for the purposes of running the chi-square test of independence. The statistical analysis compared the observed scores in each category and level of experience to the expected scores and rendered a *p* value. *P* values were deemed significant at or below the .05 level (Ary D. , Jacobs, Sorenson, & Walker, 2014; Tanner, Using Statistics to Make Educational Decisions, 2012). In this test, the responses of the four different groupings of years of experience for teachers were examined. A chi-square test was performed and the *p* value of <.01 suggested a relationship between teachers' years of experience and their perceptions of Google Classroom. The null hypothesis was then rejected:

$H_{01.}$ Teachers' years of experience does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

Table 4.7

Years of Experience Observed Likert Values

Experience	(1)	(2)	(3)	(4)	(5)	Totals
0- 5 Years	52	92	78	39	9	270
6-15 Years	44	118	140	43	15	360
16-25 Years	24	102	91	31	4	252
25+ Years	7	16	34	15	9	81
Totals	127	348	343	128	37	963

Table 4.8

Years of Experience Expected Values

Experience	(1)	(2)	(3)	(4)	(5)	Totals
0- 5 Years	35.61	91.96	96.17	35.89	10.37	270
6-15 Years	47.48	122.62	128.22	47.85	13.83	360
16-25 Years	33.23	85.83	89.76	33.50	9.68	252
25+ Years	10.68	27.59	28.85	10.77	3.11	81
Totals	127	348	343	128	37	963

Individual Prompts. In addition to the three variables' chi-square tests which examined expected responses as compared to observed responses, the chi-square test was also performed on each of the nine prompts individually to determine the relationship between the prompts and the years of experience variable. Any prompt that was found to have a *p* value of less than .05 was considered to have a significant relationship with the variable of teachers' years of experience (Ary D. , Jacobs, Sorenson, & Walker, 2014).

Prompt 1 regarding teacher productivity when utilizing the Google Classroom returned a *p* value of .26, suggesting no relationship, based upon the .05 level of significance. No relationship was found with Prompt 2 and teacher perceptions of student productivity in the Google Classroom as the *p* value was .18. Similarly, Prompt 3's *p* value calculated as .51, concerning students' missing assignments. Prompts 4, 5, and 6 were also determined to independent of the variable also, as their *p* values were too large to be considered dependent upon the variable at .43, .46, and .25 respectively. Prompt 7 also returned a *p* value which depicted no relationship between the prompt regarding teachers' planning time within the Google Classroom and the years of experience variable, reporting a *p* value of .11. Prompt 8 regarding the efficacy of teaching with the technology-based classroom had a *p* value of .18, depicting no relationship. However, to the final prompt, Prompt 9, which read, *Utilizing the Google Classroom improves student retention of the subject matter*, teachers' responses returned a *p* value of .04. This particular *p* value is considered significant as it is below the .05 level. Of the teacher responses to the nine prompts, only Prompt 9 was deemed to be dependent upon the variable of years of experience.

Table 4.9

Teachers' Perceptions by Years of Experience

Prompt	Topic	*p* value
1	Teacher productivity	.26
2	Student productivity	.18
3	Missing assignments	.51
4	Student engagement	.43
5	Assessment performance	.46
6	Student writing/creating	.25
7	Teacher planning	.11
8	Teaching efficacy	.18
9	Subject retention	.04

Prompt 9. Variances in expected and observed values lead to a possibly significant *p* value (Ary D. , Jacobs, Sorenson, & Walker, 2014). This was the case with Prompt 9 within the years of experience variable. The (2) *Somewhat Agree* response returned differing results from the expected values in all four of the years of experience categories. For instance, 13 teachers in the 6-15 years range chose (2) *Somewhat Agree* whereas 16 were expected. In the 25 or more years category, 0 teachers chose (2) Somewhat Agree where a 3.6 was expected. Also notable, the teachers with the least years of experience responses varied from that which was expected in both (2) *Somewhat Agree* and (3) *Neither Agree nor Disagree* responses: 15 and 10 observed, 12.0 and 14.8 expected, respectively.

Table 4.10

Prompt 9 Observed Likert Values

Experience	(1)	(2)	(3)	(4)	(5)	Totals
0- 5 Years	2	15	10	3	0	30
6-15 Years	2	13	23	1	1	40
16-25 Years	0	15	13	0	0	28
25+ Years	1	0	7	0	1	9
Totals	5	43	53	4	2	107

Table 4.11

Prompt 9 Expected Values

Experience	(1)	(2)	(3)	(4)	(5)	Totals
0- 5 Years	1.40	12.06	14.86	1.12	0.56	30
6-15 Years	1.87	16.07	19.81	1.50	0.75	40
16-25 Years	1.31	11.25	13.87	1.05	0.52	28
25+ Years	0.42	3.62	4.46	0.34	0.17	9
Totals	5	43	53	4	2	107

Variable Two: Teacher's Grade Level Assignment

The district's Google Classroom roll-out was designated for three specific grade levels, grades four, seven, and ten. The various grade levels allowed the district to begin implementing the technology in different school settings, such as elementary, middle, and high schools. The

district plans to add more Google Classroom grade levels during the 2017- 2018 school year. Implementing a roll-out at varied school settings allows for the roll-out teachers of this year to assist their colleagues next year. Of the 107 respondents, 39 taught fourth grade, 43 taught seventh grade, and 25 taught tenth grade.

Fourth grade. The fourth grade teacher group was comprised of 39 teachers who responded to the survey, rating their agreement or disagreement with the prompts regarding Google Classroom via the Likert scale (Ary D. , Jacobs, Sorenson, & Walker, 2014). The majority of the prompts, in fact, six of the nine prompts were found to have had the highest number of respondents choose (2) *Agree Somewhat*, denoting a somewhat positive perceptions to the technology-based Google Classroom. These prompts included Prompts 1, 2, 4, 6, 7, and 8. In the three remaining prompts though, the highest number of responses fell into the (3) *Neither Agree nor Disagree* category. In both Prompts 3 and 9, which dealt with missing student assignments and retention of the subject matter respectively, although teachers chose (3) *Neither Agree nor Disagree* most frequently, the responses were similar in frequency to the (2) *Agree Somewhat* category. This was not the case with Prompt 5. The fifth prompt which asserted that students perform better on assessments while using the Google Classroom for test-taking, the fourth grade teachers decidedly chose the middle response, (3) *Neither Agree nor Disagree.* In fact, more than half of the fourth grade teacher respondents, 23, chose the one neutral response field. Table 4.12 depicts the fourth grade teacher responses and the frequency with which each score on the Likert scale was chosen.

Table 4.12

4th Grade Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	7	15	14	3	0
2	7	18	10	4	0
3	3	11	14	7	4
4	13	18	6	2	0
5	0	9	23	5	2
6	2	17	10	8	2
7	5	14	8	10	2
8	2	19	14	4	0
9	2	16	18	3	0

Seventh grade. Seventh grade teachers made up the largest group with 43 participants. In response to the prompts, the teachers chose (3) *Neither Agree nor Disagree* most often in Prompts 3, 5, 6, 8, and 9. However, Prompt 9 also had several respondents choose (2) *Agree Somewhat,* 18 as compared to the 24 who chose (3) *Neither Agree nor Disagree.* The (2) *Agree Somewhat* category garnered the highest number of responses in Prompts 1, 2, and 4. Notably, seventh grade teachers chose (4) *Disagree Somewhat* most frequently for Prompt 7 regarding teacher planning time, while zero teachers chose option (4) *Disagree Somewhat* and (5) *Strongly Disagree* for Prompt 9 regarding student retention of subject matter.

Table 4.13

7th Grade Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	9	16	13	4	1
2	6	21	12	4	0
3	3	6	22	10	2
4	7	24	7	5	0
5	0	11	23	9	0
6	5	12	23	2	1
7	9	9	10	14	1
8	4	13	21	4	1
9	1	18	24	0	0

Tenth grade. With 25 respondents teaching tenth grade, this was the smallest of the grade-level groups. Like some of the other groups, this group had a few prompts where the highest number of responses fell into the (3) *Neither Agree nor Disagree*. Those included Prompts 1, 3, 5, and 9. However, Prompt 3 also had several responses in the (1) *Strongly Agree* category. Although other groups were positive about Prompt 4 and student engagement, this group had the highest number of selections for (1) *Strongly Agree*. Alternatively, Prompt 7 elicited the highest number of responses in the (5) *Strongly Disagree* category. The other three prompts, Prompts 2, 6, and 8 were found to have (2) *Agree Somewhat* as the most frequently chosen selection.

Table 4.14

10th Grade Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	6	6	7	5	1
2	5	8	4	7	1
3	8	3	10	3	1
4	9	5	8	3	0
5	0	7	12	3	3
6	3	12	8	1	1
7	6	3	4	3	9
8	3	8	7	4	3
9	2	9	11	1	2

Grade Level Assignment Chi-square Results

The chi-square test was again performed in Microsoft Excel to determine the relationship between teachers' responses to the survey prompts and the variable of grade level. The 963 total responses were organized into one chart of observed values. From those, the expected values were determined. The chi-square test was performed, and the *p* value returned for grade level assignments and teacher perceptions was <.01. In order for the relationship between the variables to be considered dependent, the *p* value must have calculated at or below the .05 level of significance (Ary D. , Jacobs, Sorenson, & Walker, 2014). Based upon the level of the *p* value at <.01, the variables of teachers' perceptions of the Google Classroom and their assigned grade level were determined to be dependent. Therefore, the null hypothesis was rejected:

H_{02}. Teachers' grade-level assignment does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

Table 4.15

Grade Level Assignment Observed Likert Values

Grade	(1)	(2)	(3)	(4)	(5)	Totals
4th	41	137	117	46	10	351
7th	44	130	155	52	6	387
10th	42	61	71	30	21	225
Totals	127	328	343	128	37	963

Table 4.16

Grade Level Assignment Expected Values

Grade	(1)	(2)	(3)	(4)	(5)	Totals
4th	46.29	119.55	125.02	46.65	13.49	351
7th	51.04	131.81	137.84	51.44	14.87	387
10th	29.67	76.64	80.14	29.91	8.64	225
Totals	127	328	343	128	37	963

Individual Prompts. Teachers' responses to Prompt 1 regarding their perception of productivity were determined to be independent of the grade-level variable as the *p* value was .72. Likewise, Prompt 2 was also found to be independent of the variable at p=.25. However, Prompt 3 which probes for teacher perceptions regarding missing assignments while using Google Classroom returned a *p* value of .05 which makes it significant and dependent upon the

variable. Prompt 4 regarding student engagement, although close to the level of significance, was independent of the variable due to its *p* value of .07. Teacher perceptions regarding assessment performance were deemed independent of the variable as the *p* value returned was .36. The student writing/creating prompt, Prompt 6, returned a *p* value of .07, again too large to be considered dependent upon the variable. However, Prompt 7, regarding teacher planning, returned a significant *p* value at $p<.01$. This signifies that the teacher perceptions regarding planning time in the Google Classroom were dependent upon what grade level the teachers were assigned. Prompts 8 and 9 were both ruled independent due to their insignificant *p* values of .15 and .17 respectively.

Table 4.17

Teachers' Perceptions by Grade Level

Prompt	Topic	*p* value
1	Teacher productivity	.72
2	Student productivity	.25
3	Missing assignments	.05
4	Student engagement	.07
5	Assessment performance	.36
6	Student writing/creating	.07
7	Teacher planning	<.01
8	Teaching efficacy	.15
9	Subject retention	.17

Prompt 3. Although the responses from the teachers were varied, some values were observed considerably higher or lower than expected. Chi-square tests compare the two, observed values and expected values, and when the variance is considerable, the test returns a significant *p* value (Tanner, 2012). For instance, as shown in Table 4.18 and 4.19, in response to the prompt about missing student assignments within the Google Classroom, the fourth grade teachers selected fewer (1) *Strongly Agree* responses than expected but more (2) *Agree Somewhat* and (5) *Strongly Disagree* than expected. Likewise, the seventh grade teachers selected (3) *Neither Agree nor Disagree* and (4) *Disagree Somewhat* more often than expected and chose fewer (1) *Strongly Agree* and (2) *Agree Somewhat* responses than expected. Tenth grade teachers, on the other hand, responded more positively to Prompt 3 with 8 teachers selecting (1) *Strongly Agree* while only 3 were expected. Consequently, the (2) *Agree Somewhat* and (4) *Disagree Somewhat* were chosen less frequently than expected.

Table 4.18

Prompt 3 Observed Likert Values

Grade	(1)	(2)	(3)	(4)	(5)	Totals
4th	3	11	14	7	4	39
7th	3	6	22	10	2	43
10th	8	3	10	3	1	25
Totals	14	20	46	20	7	107

Table 4.19

Prompt 3 Expected Values

Grade	(1)	(2)	(3)	(4)	(5)	Totals
4th	5.10	7.29	16.77	7.29	2.55	39
7th	5.63	8.04	18.49	8.04	2.81	43
10th	3.27	4.67	10.75	4.67	1.64	25
Totals	14	20	46	20	7	107

Prompt 7. Again, as the expected values were contrasted with observed values in response to prompt regarding the Google Classroom saving teacher planning time, variances were observed. Tables 4.20 and 4.21 depict the teachers' responses to Prompt 7 and the expected values, separated by grade level assignment. The variances between expected values and observed values were analyzed via the chi-square test which returned a significant *p* value of <.01. Tenth grade teachers rated their perceptions considerably more negatively than expected. In fact, the (5) *Strongly Disagree* response was the response selected most frequently by the tenth grade teachers totaling 9 observed responses in that category where only 2.8 were expected. Seventh grade teachers chose (4) *Disagree Somewhat* more often than expected with 14 instead of 10.85, but they did not choose (5) *Strongly Disagree* as often as expected with only 1 as compared to 4.82. Conversely, fourth grade teachers' perceptions regarding the prompt differed from the expected in the (2) *Agree Somewhat* response, resulting in 14 observed where 9.4 were expected.

Table 4.20

Prompt 7 Observed Likert Values

Grade	(1)	(2)	(3)	(4)	(5)	Totals
4th	5	14	8	10	2	39
7th	9	9	10	14	1	43
10th	6	3	4	3	9	25
Totals	20	26	22	27	12	107

Table 4.21

Prompt 7 Expected Values

Grade	(1)	(2)	(3)	(4)	(5)	Totals
4th	7.29	9.48	8.02	9.84	4.37	39
7th	8.04	10.45	8.84	10.85	4.82	43
10th	4.67	6.07	5.14	6.31	2.80	25
Totals	20	26	22	27	12	107

Variable Three: Teachers' Subject Matter

Teachers participating in the Google Classroom roll-out taught one of four subjects: English language arts, mathematics, science, or social studies. The two largest groups were English language arts comprised of 43 teachers and mathematics encompassing 39 teachers. The science and social studies groups were much smaller with 13 and 12 teachers, respectively. This difference was due to several elementary schools in the county deciding to begin the Google Classroom roll-out in only two focus subjects, specifically English language arts and

mathematics. Each of the teachers rated his or her agreement with the nine prompts of the survey which dealt specifically with how teachers perceive the Google Classroom implementation. As reflected in the research question, the relationship between the teachers' perceptions and their subject or content matter were examined.

English language arts. Teacher respondents who identified themselves as teachers of the English language arts subject, the largest group based upon subject matter distinction, answered mostly positively overall to the survey prompts. In fact, six of the nine prompts had the highest number of responses in the (2) *Agree Somewhat* choice. These included Prompts 1, 2, 4, 6, 7, and 8. However, one of these prompts, Prompt 8, which addressed the efficacy or result of teaching with the technology-based Google Classroom, had the exact same number in both the (2) *Agree Somewhat* and the (3) *Neither Agree nor Disagree* choice field. Although the choice (3) *Neither Agree nor Disagree* garnered the highest number of responses for Prompt 3 regarding fewer missing assignments while utilizing Google Classroom, the other two positive choices were considerably close with 10 responses of (1) *Strongly Agree* and 11 responses of (2) *Agree Somewhat*. Among the English language arts responses, the (5) *Strongly Disagree* choice was chosen rarely. Prompt 3 garnered the highest number of (5) *Strongly Disagree* responses with 3. Prompts 5 and 9 regarding assessment performance and subject matter retention also had the highest number of responses in the (3) *Neither Agree nor Disagree* category which was chosen 22 times by English language arts respondents in both prompts. Table 4.22 denotes the responses from teachers of the English language arts subject as well as the frequency for each of the five Likert selections.

Table 4.22

ELA Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	12	20	9	2	0
2	14	18	10	1	0
3	10	11	13	6	3
4	18	19	6	0	0
5	0	14	22	5	2
6	6	24	10	2	1
7	11	14	12	5	1
8	6	17	17	3	0
9	3	17	22	1	0

Mathematics. Although six of the prompts were found to have the highest number of responses in the (3) Neither Agree nor Disagree selection field, some of those responses were more evenly distributed than others. For instance, Prompt 1 and 8 had 14 and 16 (3) Neither Agree nor Disagree selections respectively, with close seconds in other selection options. However, Prompts 3, 5, and 9 elicited 22, 20, and 19 responses in that category; in other words, a much higher percentage of the group chose that response. Likewise, although Prompt 2 had the highest number of responses in the (2) *Agree Somewhat* category, both selections (3) *Neither Agree nor Disagree* and (4) *Disagree Somewhat* held 11 responses. Prompt 4 responses were similar in their distribution to Prompt 2. Prompt 7, however, had the highest number of responses in the (4) *Disagree Somewhat* category.

Table 4.23

Math Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	4	12	14	7	2
2	2	14	11	11	1
3	2	3	22	8	4
4	5	14	12	8	0
5	0	5	20	11	3
6	1	9	20	6	3
7	3	6	7	12	11
8	2	12	16	5	4
9	1	14	19	3	2

Science. There was only one prompt that elicited the highest number of responses in the (1) *Strongly Agree* category; however, it was tied with (2) *Agree Somewhat* at three responses each. Four more prompts, Prompts 2, 4, 8, and 9 held the highest number of responses in the (2) *Agree Somewhat* selection, with the addition of Prompt 6 which had the same number of responses in (2) *Agree Somewhat* and (3) *Neither Agree nor Disagree*. Prompts 1, 3, and 5 all held the highest number of science teacher responses in the (3) Neither Agree nor Disagree category, and zero prompts elicited the highest number of responses in (4) *Disagree Somewhat* and (5) *Strongly Disagree*.

Table 4.24

Science Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	3	1	6	3	0
2	1	8	2	2	0
3	0	4	7	2	0
4	5	6	1	1	0
5	0	5	7	1	0
6	1	5	5	2	0
7	3	3	2	5	0
8	1	7	2	3	0
9	0	8	5	0	0

Social Studies. The social studies teachers made up the smallest group of teachers based upon subject matter. Many of their prompts were found to have the highest number of responses in the (3) *Neither Agree nor Disagree* selection category: Prompts 1, 5, 6, 8, and 9. Prompt 3, incidentally, had the same number of responses for (3) *Neither Agree nor Disagree* as for (4) *Disagree Somewhat*. Social studies teachers chose (2) *Agree Somewhat* most often for Prompts 2 and 4. However, as was the case with other groups, Prompt 7 elicited the most responses in the (4) *Disagree Somewhat* category. Also, as shown in Table 4.25, this group of teachers did not have a single response in the (5) *Strongly Disagree* option.

Table 4.25

Social Studies Teacher Responses

Prompt	(1) SA	(2) AS	(3) NAD	(4) DS	(5) SD
1	3	4	5	0	0
2	1	7	3	1	0
3	2	2	4	4	0
4	1	8	2	1	0
5	0	3	9	0	0
6	2	3	6	1	0
7	3	3	1	5	0
8	0	4	7	1	0
9	1	4	7	0	0

Teachers' Subject Matter Chi-square Results

As part of the study's driving research question, the relationship between the teachers' subject matter and their perceptions of the Google Classroom was examined by way of the chi-square test. Within the chi-square test, expected frequencies of the 963 responses were compared with observed responses to determine the *p* value (Ary D. , Jacobs, Sorenson, & Walker, 2014). If the *p* value returned was less than or equal to .05, the relationship was considered significant. A significant relationship meant that the responses were dependent upon the variable; conversely, if a larger *p* value was found, the variables were independent of each other (Ary D. , Jacobs, Sorenson, & Walker, 2014). The teachers' responses by subject matter were found to be dependent, as the p value returned was <.01. Therefore, the null hypothesis was rejected:

H_{03}. Teachers' subject matter does not have a statistically significant relationship to teacher perceptions of a technology-based Google Classroom.

Table 4.26

Subject Matter Observed Likert Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	80	154	121	25	7	387
Math	20	89	141	71	30	351
Science	14	47	37	19	0	117
SS	13	38	44	13	0	108
Totals	127	328	343	128	37	963

Table 4.27

Subject Matter Expected Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	51.04	131.81	137.84	51.44	14.87	387
Math	46.29	119.55	125.02	46.65	13.49	351
Science	15.43	39.85	41.67	15.55	4.50	117
SS	14.24	36.79	38.47	14.36	4.15	108
Totals	127	328	343	128	37	963

Individual Prompts. Within the variable of subject matter, teacher responses to Prompt 1 were determined to be independent of the variable due to the *p* value of .06. Prompt 2,

regarding student productivity however, was determined to be dependent upon the variable as the chi-square test returned a *p* value of .01. Although close again, the teachers' response to the students' missing assignment prompt, Prompt 3, did not result in a significant *p* value, .06. Prompt 4 concerning student engagement was ruled dependent based upon a *p* value of <.01. Responses to Prompt 5 were deemed independent of the variable with a *p* value of .13. Prompt 6 also returned a *p* value greater than .05 (.06) and, was therefore deemed independent. Regarding planning time, Prompt 7 responses were shown to be dependent upon the variable due to a *p* value of <.01. Prompts 8 and 9, concerning teacher efficacy and subject retention, were both seen to be independent of the variable with p values at .15 and .58, respectively.

Table 4.28

Teachers' Perceptions by Subject Matter

Prompt	Topic	*p* value
1	Teacher productivity	.06
2	Student productivity	.01
3	Missing assignments	.06
4	Student engagement	<.01
5	Assessment performance	.13
6	Student writing/creating	.06
7	Teacher planning	<.01
8	Teaching efficacy	.15
9	Subject retention	.58

Prompt 2. Responses to Prompt 2 were considerably different than the expected values. For instance, English language arts teachers chose (1) *Strongly Agree* twice as many times as expected, 14 compared to 7 expected. In fact, the English language arts teachers responded quite positively, as shown by 74% of their responses being (1) *Strongly Agree* and (2) *Agree Somewhat* and only one response falling into the last two *Disagree* options. Conversely, only two math teachers chose (1) *Strongly Agree* whereas 6.6 were expected. Math teachers were not as positive and chose (3) *Neither Agree nor Disagree* as many times as they chose (4) *Disagree Somewhat*. Within the last two groups, science and social studies teachers, the largest inconsistencies were found in the (2) *Agree Somewhat* response. In response to the prompt regarding student productivity, eight science teachers chose (2) *Agree Somewhat,* whereas only 5.3 were expected. Similarly, social studies teachers were expected to choose (2) *Agree Somewhat* 5.3 times; however, the observed value was 7.

Table 4.29

Prompt 2 Observed Likert Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	14	18	10	1	0	43
Math	2	14	11	11	1	39
Science	1	8	2	2	0	13
SS	1	7	3	1	0	12
Totals	18	47	26	15	1	107

Table 4.30

Prompt 2 Expected Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	7.23	18.89	10.45	6.03	0.40	43
Math	6.56	17.13	9.48	5.47	0.36	39
Science	2.19	5.27	3.16	1.82	0.12	13
SS	2.02	5.27	2.92	1.68	0.11	12
Totals	18	47	26	15	1	107

Prompt 4. Student engagement was the topic of Prompt 4, and again several variances between the observed and expected results were present. For example, English language arts teachers reported their perceptions of student engagement again much more positively than expected. In fact, 18 English language arts chose that they (1) *Strongly Agree* that their students were more engaged with the Google Classroom as compared to the 11.6 expected. Moreover, there were zero responses in the (4) *Disagree Somewhat* category for English language arts teachers. However, the mathematics and social studies teachers chose (2) *Agree Somewhat* more often than expected and (1) *Strongly Agree* less often than expected. Responses from science teachers, although small in number, were found to be different than expected in the (1) *Strongly Agree* category with five responses. As shown by Table 4.31 and 4.32, this variance, as well as the science teachers' lower numbers in the (1) *Strongly Agree* category, caused the chi-square test to return a significant *p* value for this prompt, depicting that teachers' perceptions were dependent upon the subject matter that they teach.

Table 4.31

Prompt 4 Observed Likert Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	18	19	6	0	0	43
Math	5	14	12	8	0	39
Science	5	6	1	1	0	13
SS	1	8	2	1	0	12
Totals	29	47	21	10	0	107

Table 4.32

Prompt 4 Expected Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	11.65	18.89	8.44	4.02	0	43
Math	10.57	17.13	7.65	3.64	0	39
Science	3.52	5.71	2.55	1.21	0	13
SS	3.25	5.27	2.36	1.12	0	12
Totals	29	47	21	10	0	107

Prompt 7. The prompt regarding planning time for teachers utilizing the Google Classroom elicited responses that widely varied from the expected outcomes. For instance, considerably fewer math teachers chose the responses (1) *Strongly Agree* and (2) *Agree*

Somewhat than what were anticipated. In fact, only three math teachers chose (1) *Strongly Agree* and six chose (2) *Agree Somewhat*, where 7.29 and 9.48 were expected, respectively. Also distinguishable, the (4) *Disagree Somewhat* response was chosen more frequently than expected in every subject except English language arts. The observed responses for (4) *Disagree Somewhat* had two more responses than expected in each of the other three subjects. English teacher perceptions, as with the other prompts, appeared more positive than the other subjects' responses. Math teachers also chose (5) *Strongly Disagree* more often than expected at 11 responses where only 4.37 were expected. As shown in Table 4.33 of Prompt 7 responses and 4.34 of Prompt 7 expected values, these variances in observed and expected responses were and integral component of the chi-square test which returned a significant *p* value of $p<.01$.

Table 4.33

Prompt 7 Observed Likert Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	11	14	12	5	1	43
Math	3	6	7	12	11	39
Science	3	3	2	5	0	13
SS	3	3	1	5	0	12
Totals	20	26	22	27	12	107

Table 4.34

Prompt 7 Expected Values

Subject	(1)	(2)	(3)	(4)	(5)	Totals
ELA	8.04	10.45	8.84	10.85	4.82	43
Math	7.29	9.48	8.02	9.84	4.37	39
Science	2.43	3.16	2.67	3.28	1.46	13
SS	2.24	2.92	2.47	3.03	1.35	12
Totals	20	26	22	27	12	107

Summary of Findings

Teachers utilizing Google Classroom were surveyed for their perceptions regarding the technology's integration in their classroom. The 107 responses to the survey were collated, analyzed, and tested in an effort to answer the study's driving question: *Do teachers' years of experience, grade-level assignment, and subject matter influence teacher perceptions of a technology-based Google Classroom?* The chi-square test was performed on the responses for each of the three variables. All three null hypotheses were rejected, as each chi-square test returned a significant *p* value at $p<.01$. Therefore, it was determined that there was a relationship found between the variables of years of experience, grade level assignment, and subject matter and teachers' perceptions of the technology-based Google Classroom.

Chi-square tests were also performed on individual prompts within the variables. In the years of experience variable, Prompt 9 regarding student retention of subject matter was determined to be dependent based upon a statistically significant *p* value. Teacher perceptions were also found to be dependent upon grade-level assignments, specifically for Prompts 3

regarding missing assignments and Prompt 7 dealing with teacher planning time. Teachers' subject matter was also found to have a relationship with teacher perceptions of the Google Classroom as shown by the three prompts' chi-square tests returning a significant *p* value: Prompt 2 on student productivity, Prompt 4 about student engagement, and Prompt 7 regarding teacher planning time.

Chapter 5: Conclusion

Implementing technology into the public school classroom has been the focus of much research. Schools have tried various ways to integrate computers in the classroom, attempting to better prepare students for a technology-rich life after high school graduation with growing trends of online distance classes and technology-based career training (Keppler, Weiler, & Maas, 2014). Furthermore, with technology's ever-growing prevalence came more global connectivity which students must be able to navigate (Ismail, 2015). In fact, some proponents of the integration even claimed that technology should be used to enhance the learning experience and possibly surpass the capabilities of classroom academics without technology, all the while preparing the next generations for ubiquitous use of it (Kayalar, 2016). Despite much research, a definitive process for implementation, or even a clearly identified list of benefits, has not been established (Penuel, 2006). However, amid the various suggestions for technological integration, one pivotal role in classroom implementation remains constant: the role of the teacher. Teachers' perceptions of technology and its uses have been noted to directly affect the implementation (Cox, 2013; Ismail, 2015; Kayalar, 2016).

The school district chosen for the study had purchased Google Chromebooks for student use and trained its roll-out teachers on Google Classroom, a technology-based instructional platform. Three grade levels were included in the roll-out, as a pilot group. As participants in the district's pilot group, teachers of the three grade levels were sent a survey which was designed to gauge their perceptions of the Google Classroom implementation and had been previously field-tested. The survey was delivered to the roll-out teachers mid-way through the roll-out year, after one semester's completion. The district utilizes block scheduling at the high school level, so for the 10th grade teachers, the semester's end marked the end of the course. Of the 136 pilot

teachers, 107 responded to the voluntary survey, ranking their level of agreement with nine different prompts via Likert scale. The prompts were designed to elicit teachers' attitudes regarding the implementation of the technology-based Google Classroom. The teachers also answered simple demographic questions regarding their years of teaching experience, grade level assignment, and subject matter. These were in an effort to answer the study's driving question:

> *Do teachers' years of experience, grade level assignment, and subject matter influence teacher perceptions of a technology-based Google Classroom?*

Summary of Findings

A chi-square test of independence was completed on the three variables of the research question, and all three tests returned a statistically significant *p* value, suggesting the dependence of the variables of years of experience, grade level assignment, and subject matter on teacher perceptions of Google Classroom; therefore, the null hypotheses were rejected. Moreover, chi-square tests were also run on the nine different prompts within each of the three variables. In each test, certain prompts were also shown to be dependent. Within the years of experience variable, responses to Prompt 9 regarding student retention of subject matter returned a *p* value indicating significance. Within the grade level variable, responses to Prompts 3 and 7 were found to be dependent upon the teachers' grade level. Finally, within the subject matter variable, three prompts, Prompts 2, 4, and 7 were found to have a relationship with teachers' subject matter.

Holistically, the roll-out teachers responded somewhat positively to the nine prompts and selected the (5) *Strongly Disagree* option the least frequently. The two most frequently chosen responses to the prompts were (2) *Agree Somewhat* and (3) *Neither Agree nor Disagree.* These two choices garnered more than 60% of the responses in every prompt but one, Prompt 7, which dealt with teacher planning time. Prompt 7 was the only prompt which had the highest number of

responses in the (4) *Disagree Somewhat* selection. Conversely, there was also one particular prompt to which teachers responded very favorably, Prompt 4 regarding student engagement. This was the only prompt to elicit the highest number of responses in the (1) *Strongly Agree* category. In fact, teachers responded overwhelmingly in agreement with the prompt: *Students appear more engaged (asking questions, offering input, researching to find answers) in class when utilizing Google Classroom.* To this prompt, 71% of the teachers chose (1) *Strongly Agree* or (2) *Agree Somewhat*, with an additional 19.6% choosing (3) *Neither Agree nor Disagree*. In total, the first three options garnered 90.6% of the responses. Coinciding with this, responses to these two prompts were also found to be statistically significant within different variables' chi-square tests. In fact, responses to Prompt 7 were determined to be dependent upon teachers' grade level and subject matter, whereas responses to Prompt 4 returned a significant *p* value in the variable of subject matter.

Discussion and Implications

Years of Experience. Responses were categorized and analyzed in groups of years of experience. An analysis of the responses for each category corroborated the chi-square test results: teachers' perceptions of the Google Classroom were dependent upon their years of experience. Of the four categories, the 30 teachers with the least years of experience chose (1) *Strongly Agree* more than any other group; 19.3%. In the next group, 12.2% of the teachers with 6-15 selected (1) *Strongly Agree*. The percentage of (1) *Strongly Agree* answers continued to decrease in the 16-25 category at 9.5% and in the 25 years or more category at 8.6%. However, even more notable, teachers with more than 25 years of experience were considerably less positive in their responses, selecting both choices (4) *Disagree Somewhat* and (5) *Strongly Disagree* at a much higher rate than the other groups. This finding may imply that younger

teachers are more familiar with technology, especially having recently attended college and pre-service trainings (Ismail, 2015). Furthermore, the teachers with the least amount of experience have grown up in a technology-rich society, and likely used it while they were in school, whereas teachers with more than 25 years of experience would have had to make efforts to acquire technological adeptness (Kayalar, 2016). To mediate this discrepancy, schools may need to incorporate different levels of technological training for teachers, based upon their proficiency levels with technology. Furthermore, similar to utilizing mentoring teachers, some teachers with the least technological experience, or even those with negative presumptions, could be paired with a colleague with whom to plan and learn the new web-based platform.

Grade Level Assignment. The three grade levels of the district's Google Classroom roll-out included grades four, seven, and ten. The chi-square test returned a significant p value, indicating that teacher perceptions of Google Classroom were, in fact, dependent upon their grade level assignment. The percentages for responses from teachers of grades four and seven were distributed similarly throughout the 1-5 Likert choices. However, interestingly, the teachers of tenth grade had both a higher percentage of strong agreement and strong disagreement than either of the other groups. Of the high school teachers, 18.7% chose (1) *Strongly Agree* to the prompts, as compared to 11.7% of fourth grade and 11.4% of seventh grade. Likewise, tenth grade teachers also chose (5) *Strongly Disagree* at a higher rate than the other two groups; the percentage of 9.3% was more than two times the other two groups combined. This finding may be reflective of several things. For instance, the high school teachers are the only teachers in the roll-out group who ended a course at the semester's end. The groups of fourth and seventh grade teachers keep their students year-long. The variance in the response choices could also be due to the high school level teachers' training and teaching being more subject-specific. Furthermore,

tenth grade students are already accustomed to utilizing technology in various ways such as cell phones, word processing programs, social media, and so on. This previous exposure may help assist the technological integration at the high school level, especially in light of the constraints of one semester classes. This inference coincides with previous research which found that the biggest difference in teachers' integration of technology was based upon grade level, stating that secondary level teachers were more likely to use technology in the classroom than elementary and middle grade teachers (Gorder, 2008).

Subject Matter. One particularly interesting finding was that teachers of mathematics chose (4) *Disagree Somewhat* and (5) *Strongly Disagree* more often than any other subject. In fact, science and social studies teachers, albeit smaller groups, had zero responses in the (5) *Strongly Disagree* category in response to all nine of the prompts. Although the majority of the math responses fell into the (3) *Neither Agree nor Disagree* choice, the number of responses in the last two choices, (4) *Disagree Somewhat* and (5) *Strongly Disagree*, total more than all three of the other subjects combined. This could possibly reflect mathematics teachers' attitudes that Google Classroom and its educational suite of online tools do not necessarily lend themselves to the teaching of mathematical equations and number sequencing. Moreover, English language arts and science teachers were noticeably more agreeable with their responses. In fact, the (2) *Agree Somewhat* choice was selected most frequently for both groups. This corresponds with studies claiming that science and English skills can be enhanced by the use of technology and tools such as Google Docs (Bebell & Kay, 2010; Shapley, et al., 2006; Suwantarathip & Wichadee, 2014). As Google Classroom becomes more widespread in its use, it is possible that more mathematics tools and extensions could be added, thereby alleviating some of the disconnect between the subjects.

Based upon teacher responses, one positively perceived effect of the technological integration is improved student engagement. This finding echoes the sentiments of constructivism (Liu & Chen, 2010). As students participate in the Google Classroom, they are typing, searching the internet, messaging their teacher and peers, collaborating on projects and more. These experiences appear more interactive in nature than listening to lectures; therefore, teachers may perceive that students are more engaged based upon their activity level. Furthermore, the interactive experience of a technology-based classroom incorporates the skills students utilize outside of the classroom as digital natives (An & Reigeluth, 2011). In fact, some research calls for a more student-centered approach which Google Classroom provides based upon the knowledge that students are used to interacting online with others via cell phones, email, and social media (Hariadi, Dewiyani, & Sudarmaningtyas, 2016).

Teachers responded negatively in regards to their planning time. This implies that teachers opined that adding the Google Classroom to their instruction has caused them to spend more time in creating lessons, planning the collaborative assignments, and so on. However, it should be noted that these negative perceptions may reflect the fact that the implementation and the technology was brand new, thus requiring teachers to learn how to create items for the students for the first time. If the study had taken place after the initial roll-out year, teachers may have felt more established in the technology and its requirements. Moreover, in ensuing years, teachers will have their previously created assignments and lessons from which to select. Finally, as teachers familiarize themselves with Google Classroom, planning time may be reduced.

Conclusions

Although technological benefits are touted widely, there remains a lack of definitive data to prove that technology enhances student learning. In addition, the lack of a clear procedural

plan for implementation suggests that the research regarding technology in the classroom is unfinished and ever-changing. However, one role remains pivotal in any classroom integration: the role of the teacher. As teachers undertake the task of teaching via technology, they also bring with them their preconceived attitudes toward it. In this study, teacher perceptions were found to be generally positive toward the technology-based Google Classroom implementation. Furthermore, a chi-square test of independence was performed to analyze the relationship between teachers' perceptions and their years of experience, grade level assignment, and subject matter. The relationships between the variables were significant at the $p<.05$ significance level. In response to the study's driving question, the research found that teachers' perceptions of the technology-based Google Classroom were dependent upon their years of experience, grade level assignment, and subject matter.

Recommendations for Further Research

Further research regarding the integration of technology into the educational classroom is paramount. Specifically, because this study was implemented in the initial roll-out year, future years should be observed to determine whether teacher perceptions change after continued use of Google Classroom. In fact, a study encompassing several years of the roll-out would be appropriate, especially one that includes a more pervasive integration not limited to a pilot group of three grade levels. Likewise, because Google Classroom and Google Chromebooks are relatively new and because technology's scope is ever-widening, studies should be continued to assess new upgrades, product longevity, and sustained applicability.

As technology continues to be made more readily available, exposure and usage will increase, not only for students but also for teachers. Therefore, teacher preparedness trainings may need to change. For instance, as some teachers who may consider themselves reticent to

incorporate technology retire and are replaced by younger, more technologically adept teachers, pre-service and in-service trainings will have to reflect that change and address not only overall technological training but also training specific to facilitating and enhancing student use of it. Furthermore, due to the teacher's pivotal role in any technological integration, measures should be taken to assess teacher perceptions prior to implementation, as well as continued familiarization and support throughout the school year.

Finally, although quantitative studies remain mixed in their reports of increased academic assessment performance after a technological initiative, further research should attempt to determine and hone specific practices which increase achievement. Once identified, teacher trainings and usage should be studied to assess the alignment with such practices. Moreover, further qualitative studies are in order to provide a rich description of teacher perceptions, in order to identify certain views and attitudes which may help or hinder full implementation.

References

Aflalo, E. (2014). The invisible barrier to integrating computer technology in education. *Journal of Education and Learning, 3*(2), 120-134. doi:10.5539/jel.v3n2p120

Aldoobie, N. (2015, December). Technology integration and learning theory. *American International Journal of Contemporary Research, 5*(6).

An, Y.-J., & Reigeluth, C. (2011). Creating technology-enhanced, learner-centered classrooms:K–12 teachers' beliefs, perceptions, barriers, and support needs. *Journal of Digital Learning in Teacher Education, 28*(2), pp. 54-62.

Anthony, A. B. (2012). Activity theory as a framework for investigating district-classroom system interactions and their influences on technology integration. *Journal of Research on Technology in Education, 44*(4), pp. 335-356.

Ary, D., Jacobs, L. C., Sorenson, C., & Walker, D. A. (2014). *Introduction to research in education* (9th ed.). Belmont, CA: Cengage.

Ary, D., Jacobs, L. C., Sorenson, C., & Walker, D. A. (2014). *Introduction to Research in Education.* Belmont, CA: Wadsworth Cengage Learning.

Bakia, M., Means, B., Gallagher, L., Chen, E., & Jones, K. (2009). *Evaluation of the enhancing education through technology program final report.* Washington, DC: Department of Education, Office of Planning, Evaluation, and Policy Development.

Bass, B. M., & Bass, R. (2009). *The Bass handbook of leadership: Theory, reserach & mangerial applications.* New York, NY: Simon & Schuster.

Bebell, D., & Kay, R. (2010, January). One to one computing: A summary of the quantitative results of the Berkshire Wireless Learning Initiative. *The Journal of Technology, Learning, and Assessment, 9*(2), 1-60.

Bebell, D., & O'Dwyer, L. M. (2010, January). Educational outcomes and reserach from 1:1 computing settings. *The Journal of Technology, Learning, and Assessment, 9*(1), 1-16.

Chiang-Lin, T., Hsu, Y.-S., & Cheng, Y.-J. (2011, April). Emerging innovative teacher education from situated cognition in a web-based environment. *The Turkish Online Journal of Educational Technology, 10*(2), pp. 100-112.

Cox, J. (2013). Tenured teachers & technology integration in the classroom. *Contemporary Issues In Education Research, 6*(2), pp. 209-218.

Donna, J. D., & Miller, B. G. (2013, Summer). Using cloud-computing applications to support collaborative scientific inquiry: Examining pre-service teachers' perceived barriers to integration. *Canadian Journal of Learning and Technology, 39*(3), 1-17.

Dunleavy, M., & Heinecke, W. F. (2007). The impact of 1:1 laptop use on middle school math and science standardized test scores. *Computers in the Schools, 24*(3/4), 7-22.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration. *Educational Technology Research & Development, 53*(4), pp. 25-39.

Fullan, M. (2011). *Change leader: Learning to do what matters most.* San Francisco, CA: Jossey-Bass.

Gilakjani, A. P. (2013). Factors contributing to teachers' use of computer technology in the classroom. *Universal Journal of Educational Research, 1*(3), 262-267.

Goodwin, B. (2011, February). Research says... One to one laptop programs are no silver bullet. *Educational Leadership, 68*(5), 78-79.

Google. (2016). *About Classroom*. Retrieved from Google: https://support.google.com/edu/classroom/answer/6020279?hl=en

Gorder, L. M. (2008, Spring/Summer). A study of teacher perceptions of instructional technology integration in the classroom. *The Delta Pi Epsilon Journal, L*(2), pp. 63-76.

Gulek, J. C., & Demirtas, H. (2005, January). Learning with technology: The impact of laptop use on student achievement. *The Journal of Technology, Learning, and Assessment, 3*(2), 1-39.

Hariadi, B., Dewiyani, M., & Sudarmaningtyas, P. (2016, March). Development of web-based learning application for generation Z. *International Journal of Evaluation and Research in Education, 5*(1), pp. 60-68.

Iftakhar, S. (2016, February). Google classroom: What works and how? *Journal of Education and Social Sciences, 3*, pp. 12-18.

Ismail, N. (2015). The integration of new media in schools: comparing policy with practice. *International Education Studies, 8*(12), pp. 231-240. doi:10.5539/ies.v8n12p231

Kayalar, F. (2016, April). Cross-cultural comparison of teachers' views upon integration and use of technology in classroom. *The Turkish Online Journal of Educational Technology, 15*(2), pp. 11-19.

Keppler, M., Weiler, S. C., & Maas, D. (2014). Focused ubiquity: A purposeful approach to providing students with laptops. *Educational Technology & Society, 17*(4), 278-288.

Knowlton, D. S. (2000, Winter). A theoretical framework for the online classroom: A defense and delineation of student-centered pedagogy. *New Directions for Teaching and Learning*, pp. 4-14.

Larkin, K. (2011). You use! I use! We use! Questioning the orthodoxy of 1:1 computing in primary schools. *Journal of Research on Technology in Education, 44*(2), 101-120.

Lin, Y.-T., & Jou, M. (2013, April). Integrating popular web applications in classroom learning evironments and its effects on teaching, student learning motivation and perfromance. *The Turkish Online Journal of Educational Technology, 12*(2), pp. 157-165.

Liu, C. C., & Chen, I. J. (2010, April). Evolution of constructivism. *Contemporary Issues In Education Research, 3*(4), pp. 63-66.

MacKinnon, S. (2002, October-December). Technology Integration in the Classroom: Is there only one way to make it effective? *TechKnowLogia*, pp. 57-60.

Osler, J., Hollowell, G., & Nichols, S. (2012). Technology engineering in science education: Where instructional challenges interface nonconforming prodictivity to increase retention, enhance transfer, and maximize student learning. *i-manager's Journal of Educational Technology*, pp. 31-39.

Ouyang, J. R., & Stanley, N. (2014). Theories and research in educational technology and distance learning instruction through blackboard. *Universal Journal of Educational Research, 2*(2), pp. 161-172. doi:10.13189/ujer.2014.020208

Owen, A., Farsaii, S., Knezek, G., & Christensen, R. (2006, January). Teaching in the one-to-one classroom: It's not about laptops, it's about empowerment! *Learning & Leading with Technology, 33*(4), 12-16.

Penuel, W. R. (2006, Spring). Implementation and effects of one-to-one computing intiatives: A research synthesis. *Journal of Research on Technology in Education, 38*(3), 329-348.

Prensky, M. (2013, March). Our brains extended. *Educational Leadership, 70*(6), 22-27.

Sauers, N. J., & McLeod, S. (2012). *What does the research say about scool one-to-one computing initiatives?* Lexington, KY: UCEA Center for the Advanced Study of Technology Leadership in Education.

Schcolnik, M., Kol, S., & Abarbanel, J. (2006). Constructivism in theory and practice. *English Teaching Forum, 4,* pp. 12-20.

Sell, R. G., Cornelius-White, J., Chang, C.-W., McLean, A., & Roworth, W. R. (2012). *A meta-synthesis of reserach on 1:1 technology initiatives in K-12 education.* Missouri State University, Institute for School Improvement. Springfield, MO: Ozarks Educational Research Initiative.

Shapley, K., Sheehan, D., Sturges, K., Caranikas-Walker, F., Huntsberger, B., & Maloney, C. (2006). *Evaluation of the Texas Technology Immersion Pilot.* Texas Center for Educational Research. Retrieved from http://www.setda.org/wp-content/uploads/2013/12/Texas_Year3FinalReport.pdf

Shin, W. S., Han, I., & Kim, I. (2014). Teachers' technology use and the change of their pedagogical beliefs in Korean educational context. *International Education Studies, 7*(8), pp. 11-22. doi:10.5539/ies.v7n8p11

Shinsky, E. J., & Stevens, H. A. (2011, December). Teaching in educational leadership using web 2.0 applications: Perspectives on what works. *Journal of Research on Leadership Education, 6*(5), pp. 195-215.

Spires, H. A., Oliver, K., & Corn, J. (2012). The new learning ecology of one-to-one computing environments: Preparing teachers for shifting dynamics and relationships. *Journal of Digital Learning in Teacher Education, 28*(2), 63-72.

Storz, M. G., & Hoffman, A. R. (2013). Examining response to a one-to-one computer initiative: Student and teacher voices. *RMLE Online, 36*(6), 1-18.

Suwantarathip, O., & Wichadee, S. (2014, April). The effects of collaborative writing activity using Google Docs on students' writing abilities. *The Turkish Online Journal of Educational Technology, 13*(2), 148-156.

Tanner, D. (2012). *Using Statistics to Make Educational Decisions.* Fresno: Sage Publications.

Tanner, D. (2012). *Using Statistics to Make Educational Decisions.* Thousand Oaks, CA: SAGE Publications.

Tsai, H.-C. (2015). A senior teacher's implementation of technology integration. *International Education Studies, 8*(6), pp. 151-161. doi:10.5539/ies.v8n6p151

Vickers, R., Field, J., & Melakoski, C. (2015). Media culture 2020: Collaborative teaching and blended learning using social media and cloud-based technologies. *Contemporary Educational Technology, 6*(1), pp. 62-73.

Weston, M. E., & Bain, A. (2010, January). The end of techno-critique: The naked truth about 1:1 laptop initiatives and educational change. *The Journal of Technology, Learning, and Assessment, 9*(6), 1-26.

Wright, V. H., & Wislon, E. K. (2011). Teachers' use of technology: Lessons learned from the teacher education program to the classroom. *SRATE Journal, 20*(2), pp. 48-60.