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ONE-TO-ONE iPAD TECHNOLOGY: PERCEPTIONS VERSUS PRACTICE

Christopher Pipala

ONE-TO-ONE iPAD TECHNOLOGY: PERCEPTIONS VERSUS PRACTICE

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Christopher Pipala

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Christopher Pipala Dr. Mary Ellen Freeley

ABSTRACT

ONE-TO-ONE iPAD TECHNOLOGY: PERCEPTIONS VERSUS PRACTICE

Christopher Pipala

This study sought to determine how iPads were used for instruction in the secondary schools of a suburban school district as well as determine if a relationship existed between teacher beliefs about technology and the potential level of transformative integration of the devices in classroom instruction. The Technological Pedagogical Content Knowledge (TPACK) and Substitution, Augmentation, Modification, and Redefinition (SAMR) models comprised the theoretical framework for this study to facilitate discussion about the level of instructional transformation that resulted from the use of iPad technology.

This study utilized the Technology Uses and Perceptions Survey (TUPS) and Technology Integration Matrix Reflection (TIM-R) tool from the Florida Center for Instructional Technology. Descriptive statistics were used to show the variety of instructional modes for which iPads were being used (as measured by the TUPS). Correlational analyses determined that positive a relationship existed between teacher perceptions about technology (as measured by the TUPS) and the use of iPads in the classroom. However, no significant relationship existed between these perceptions and the potential level of transformative technology integration in the classroom.

The findings of this study will contribute to the body of research on the integration of instructional technology (specifically one-to-one computing devices) in the classroom and help inform the technology program and professional development of the sample district.

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To my parents, thank you for providing me with every opportunity imaginable in life. Your years of sacrifice and selfless love have made attainable all of my dreams and aspirations. My education would never have been possible without you. These words hardly describe the level of gratitude I have for all you have done for me. Though I rarely say it enough - *thank you* and I love you.

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Finally, to my cohort, thank you for helping to make this process one that was full of laughter. I will look back fondly on our time spent together.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

The use of one-to-one computing devices is increasing in classrooms across the world. In 2015, more than half of K-12 students in the United States utilized or had access to 1:1 devices. This figure represents an increase of 100% from just three years prior, demonstrating the speed with which mobile devices are being adopted in schools nationwide (Molner, 2015). However, ubiquitous access to technology is not enough to increase student achievement or drastically change the nature of classroom instruction. Educators often utilize the devices as a replacement for traditional teaching routines rather than using them to transform the way teaching and learning occurs in the classroom (Loschert, 2015). Research indicates that teachers perceptions and beliefs about technology greatly influence the choices a teacher makes regarding the integration of technology for classroom instruction (Ertmer, 2005). Teachers' perceived value of technology and confidence in their technological abilities are among the leading factors that impact implementation of a school technology program (Shifflet & Weilbacher, 2015). However, research suggests there may be inconsistencies between teachers' pedagogical beliefs and actual instructional use of technology (Judson, 2006; Levin & Wadmany, 2005).

This study examines how a one-to-one iPad program is being used at the secondary level of a suburban school district and determines if a relationship exists between teacher beliefs about technology and the integration of the iPads in their instruction.

Purpose of Study

The purpose of this study was to examine how iPads are being used for instruction at the secondary level of a suburban school district and the relationship between teacher perceptions about technology and the potential level of transformative technology integration in secondary classrooms of the sample district. More specifically, the study investigated whether a relationship exists between four areas of technology use perceptions: access to support, preparation for technology use, confidence and comfort using technology, and the perceived usefulness of instructional technology. The study also examined if a relationship exists between these four areas of technology perceptions and the level of potential technology integration in the classroom. Finally, the study sought to determine which of the four areas of technology use perception represents the greatest predictor of potential technology integration in the classroom.

Theoretical Framework

In order for educators to successfully integrate instructional technology into their teaching, they must not only understand the technology but also possess a deep level of knowledge of their content area as well as the foundations of effective pedagogy. One, without the other, inevitably leads to ineffective instruction. Mishra and Koehler (2006) developed the Technological Pedagogical and Content Knowledge (TPACK) framework to address how what is taught (content) and how it is taught (pedagogy) effectively integrate with instructional technology. Kurt (2018) indicates that the order of these types of knowledge is important because the technology being implemented must communicate the content and support the pedagogy in order to enhance students' learning experience. In other words, the technology must be used to support the content in a way that enhances student learning rather than the technology being the sole focus of a lesson. To best understand the TPACK framework, we must first break down each part that forms the whole. See figure 1 for a visual representation of the TPACK framework:

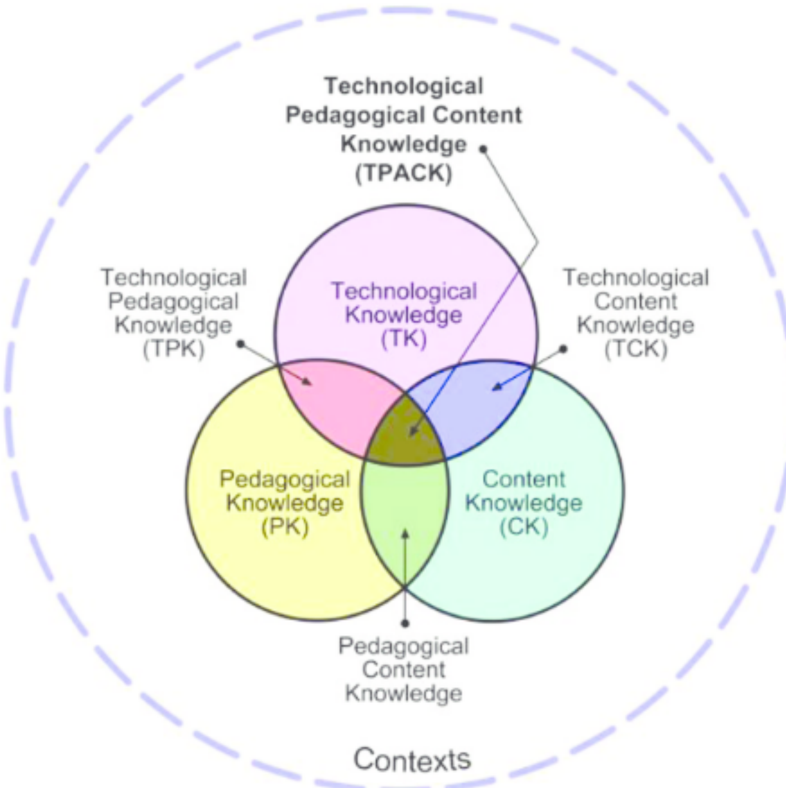

Figure 1. Technological Pedagogical Content Knowledge. Reprinted from www.tpack.org. 2012

Content Knowledge (CK) refers to a teacher's knowledge of the subject matter. This may include the concepts, central facts, theories, or procedures within a given field as well as the frameworks that connect and organize ideas (Schulman, 1986). Pedagogical Knowledge (PK) describes "the processes and practices or methods of teaching and learning and how it encompasses, among other things, overall educational purposes, values, and aims" (Mishra & Koehler, 2006, p. 1026). Pedagogical knowledge includes all aspects of student learning, classroom management, lesson planning, and assessment, including a deep understanding of students' cognitive and social development and its application to classroom instruction. Technological Knowledge (TK) refers to a teacher's knowledge of an ability to use various technological tools and resources. This includes an understanding of how technology assists or impedes traditional instruction as well as a capacity for continual learning to adapt to ever-changing technological offerings.

According to the TPACK model, once you unpack the individual forms of knowledge, the next step towards full integration is understanding how these forms of knowledge intersect and interact with one another. Pedagogical Content Knowledge (PCK) is concerned with understanding the best practices for teaching specific content to specific students. Prior to the availability of classroom technology, the intersection of PCK was what most concerned teachers in their pursuit of effective pedagogy. Mishra and Koehler (2006) elaborate "This knowledge includes knowing what teaching approaches fit the content, and likewise, knowing how elements of the content can be arranged for better teaching.... It also involves knowledge of teaching strategies that incorporate appropriate conceptual representations in order to address learner difficulties and misconceptions and foster meaningful understanding" (p. 1027). Technological Content Knowledge (TCK) refers to an understanding of how different instructional technologies can facilitate or transform the deliverance of content as well as which technologies are best suited for individual classrooms, type of content, or group of learners. The third intersection, Technological Pedagogical Knowledge (TPK) involves teachers' knowledge of how technology can transform the process of teaching.

TPACK, the interweaving of all combinations, represents a teacher's understanding of the interconnectedness of all form of knowledge. Mishra and Koehler (2006) explain:

> "TPACK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones" (p. 2019).

The TPACK framework can be utilized as a means of understanding the limitations of certain teachers' capacity for technology integration. Many teachers possess mastery of subject matter (CK) and the means for delivering content to students (PK), however without sufficient knowledge of how technology can be integrated to support these areas of strength (TK), the technology will do little, if anything, to positively influence teaching and learning. Similarly, teachers with a great deal of technological skill (TK) but little content or instructional knowledge (CK and PK) will be unable to best serve students' needs. For this reason, the modern education "requires continually creating, maintaining, and re-establishing a dynamic equilibrium among all components" (Koehler, 2012, p. 13).

While the TPACK model offers a framework for understanding the required knowledge for teachers to successfully implement instructional technology in the classroom, the model in and of itself does little to address the *degree* to which technology is utilized to transform pedagogy. For this reason, we turn to Reuben Puentedura's SAMR model to assess how instructional technology is incorporated in a classroom:

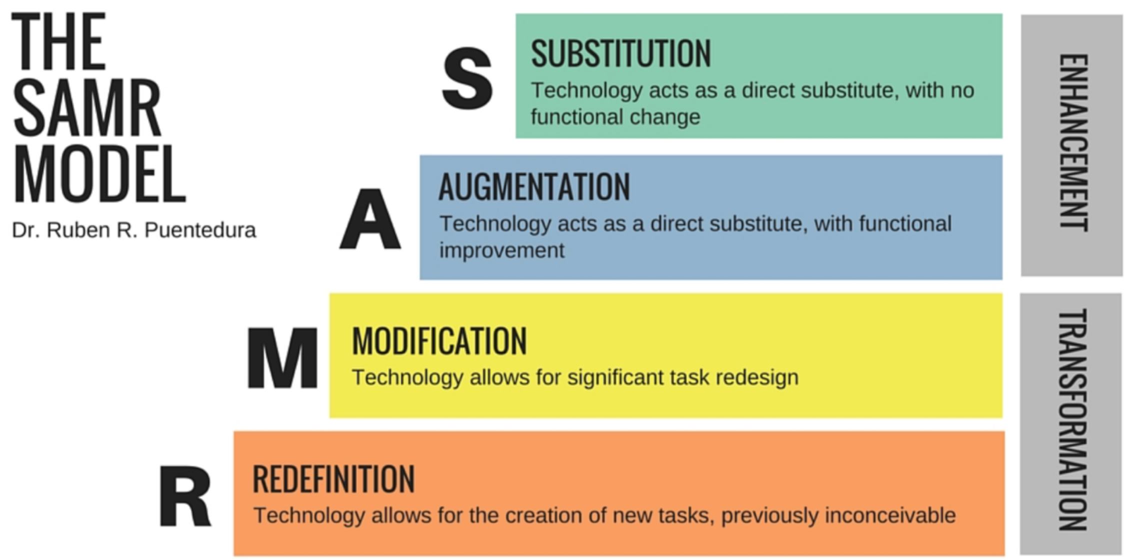

Figure 2. The SAMR Model. Lefflerd. Reprinted from Wikimedia Commons (n.d.)

The four facets of the SAMR model (which stand for Substitution, Augmentation, Modification, and Redefinition) fall within a spectrum that indicates the degree to which the incidence of the technology *changed* the instructional design of a lesson. Substitution is the simplest way to integrate technology in a lesson (Hockley, 2013). Substitution is found in activities that could have been completed without the use of a technological device. Using a web-based document rather than a printed hard copy or typing notes on a laptop computer rather than using pen and paper in a notebook are examples of substitutions. At the Augmentation level, technology again acts as a direct substitute, however does offer some functional improvement. An example of an augmented activity is using a DVD or YouTube video to immerse a student in a lesson about marine biology. The content delivered by the video is identical to that on a printed page of a textbook, however the video and audio components to the material provide greater contextualization and situated learning experience than the static material (Romrell, Kidder, & Wood, 2014). At the Substitution and Augmentation levels of the spectrum, the use of technology may *enhance* the practice (through facilitation of the task or deeper immersion in content, for example), but in no way changes the lesson design, student tasks, or desired outcomes.

The final two levels of the SAMR model, Modification and Redefinition, are considered to lead to *transformation* of practice rather than just enhancement. Hockly (2013) explains that it is in modification and redefinition that the true potential of instructional technology integration is fully realized. At the level of modification, there is a significant redesign of standard tasks and learning activities. In a 1:1 environment, traditional whole-group lessons can be modified in a way that permits each student to participate individually, supporting the personalized nature of the learning experience that was not possible without a true re-design of traditional tasks (Romrell, Kidder, & Wood, 2014).

In a World Language class, for example, students may use tablet devices to view listen to authentic audio input or simultaneously respond orally to a given prompt. In this case, the lesson is redesigned in a way that allows for all learners to gain individual exposure to the target language (as well as teacher feedback) simultaneously whereas in a more traditional setting only one student may have participated at any given time in the absence of 1:1 instructional technology. The final level of the SAMR model, Redefinition, entails the creation of new tasks that were previously inconceivable without the use of technology. A social studies class studying their country's judicial system may engage in a video-conference with students from another country to discuss how their system differs from their own. In this example, the interactive and cross-cultural lesson would not have been possible or even conceivable without the availability of instructional technology, thus exemplifying the Redefinition level of the SAMR model. It is important to note that the SAMR model is not meant to be interpreted in a hierarchical manner in which the ultimate goal is always to reach the level of Redefinition. Rather, SAMR is a spectrum in which each level may be the best option for a given lesson or population or students.

The TPACK and SAMR frameworks must not be utilized exclusively from one another. Collectively, the frameworks help researchers, school leaders, and teachers understand *how* one understands the intersection of technology with curriculum and teaching (TPACK) and to what extent the technology redefines traditional pedagogical mechanisms in the classroom (SAMR). Hilton (2016) explains that both models:

> provide important directions for ways that (teachers) can think specifically about how to integrate technology into their classrooms to maximize their use of resources and the learning possibilities of their students. While each model differs in its strengths and weaknesses, both models not only provide a capacity for (teachers) to reflect on their previous lessons but each model also presents an opportunity to plan for future technology integration that makes best use of emerging technology and exciting pedagogy (p. 73).

The TPACK and SAMR frameworks are utilized in this study as a guide in the analysis of quantitative data collected from the Technological Uses and Perceptions Survey (TUPS) and the Technology Integration Matrix Reflection (TIM-R). Together the

TPACK and SAMR models will provide a foundation for understanding *how* technological knowledge influences teachers' use of iPads in the secondary classrooms (TPACK) and for illustrating the results of the correlational-predictive study that aims to examine the relationship between teacher perceptions of technology and the level of transformative technology integration in the classroom (SAMR).

Significance of the Study

This study adds to the body of research on the role of teacher beliefs about technology programs in schools and school districts. The study examined the areas of teacher beliefs that yield the greatest potential level of technology integration (specifically 1:1 technology integration) at the secondary level and identify the areas that may inhibit a technological shift in classroom pedagogy. Therefore, this study adds to the field by exploring best practices in the integration of 1:1 classroom technology through the reflection from secondary classroom teachers.

At the local level of the sample district, the study serves as a form of action research that provides valuable information about the modes of instruction for which the 1:1 iPad program is being used at the secondary level. The results of data analysis and discussion regarding teacher perceptions and their relationship with potential for transformative technology integration will serve to help inform the sample district's future technology and professional development planning.

Research Questions

This study examined how iPads are being used for instruction at the secondary level of a suburban school district as well as the relationship between teacher ideas and perceptions about technology as measured by the Technology Uses and Perceptions Survey (TUPS) and perceived level of technology integration as measured by the TUPS and Technology Integration Matrix-Reflection Tool (TIM-R). The research questions that guide this study are:

RQ1: For what modes of instruction are 1:1 iPads being used at the secondary level of a suburban school district?

RQ2: What is the relationship between four areas of teacher technology perceptions (access to support, preparation for technology use, confidence and comfort using technology, and the perceived usefulness of instructional technology), as measured by the TUPS.

RQ3: What is the relationship between teachers' perceptions about technology and average frequency of use of iPads across a variety of teaching modes (as measured by the TUPS)?

RQ4: What is the relationship between teachers' perceptions about technology (as measured by the TUPS) and level of potential transformative technology integration (as measured by the TIM-R) controlling for total years teaching, total years teaching in a 1:1 classroom, average number of students per class, and subject area taught?

Definition of Terms

One-to-One (1:1): A classroom technology program in which each student is provided or allowed to bring their own device for use in classroom instruction.

Teaching Modes**:** The forms in which teachers use technology to deliver or facilitate the acquisition of content and skills. The modes defined in this study are: small group instruction, individualized instruction, collaborative / cooperative learning, independent learning (in school or at home), flipped learning, tutoring / remediation, as a research tool, as a tool for the planning and management of projects, as a productivity tool, as a presentational tool, as a means of facilitating discussion, as a means of delivering instruction (i.e. screen mirroring), as a communication tool, as a means of creating new instructional content, and as a means of assessment.

TIM: The Technology Integration Matrix, a "pedagogically-centered model for planning, describing, and evaluating technology integration" (Harmes et al., 2016, p. 162).

TIM-R: The TIM Observation Tool used by classroom teachers to reflect on technology integration in a particular lesson. The TIM-R establishes a TIM level for the lesson (Florida Center for Instructional Technology, n.d.).

Technology Integration Potential: A teacher's level of classroom technology integration, as measured by the TIM-R, based on a lesson perceived by the teacher to employ the greatest degree of transformative technology use.

Transformative learning: Learning that promotes future ready skills, such as the student as an empowered learner, digital citizen, knowledge constructor, innovative designer, computational thinker, creative communicator, and global collaborator (ISTE, 2016). Transformative learning with technology is distinguished from basic technology use, such as rote drill and practice, simple Internet research, and traditional writing and presentation preparation in that the learner is given opportunity for self-regulated learning in a student-centered learning environment.

TUPS: The Technology Uses and Perceptions Survey, a web-based tool used to capture teacher beliefs about the role of technology in the classroom, comfort and confidence levels in using technology, and the pedagogy of using technology in learning activities (FCIT, n.d.).

In summary, this study sought to determine how iPads are used for instruction in the secondary schools of a suburban school district as well as determine if a relationship exists between teacher beliefs about technology and the potential level of integration of the devices in classroom instruction. The Technological Pedagogical Content Knowledge (TPACK) and Substitution, Augmentation, Modification, and Redefinition (SAMR) models served as frameworks for discussion in chapter 5 regarding how content knowledge and pedagogical intersect with instructional technology. The Technology Uses and Perceptions Survey (TUPS) and Technology Integration Matrix Reflection (TIM-R) tool from the Florida Center for Instructional Technology were used to collect data on how iPads are used and how teachers perceive the usefulness of technology, their comfort with iPads, level of support, and preparation for iPad use in the classroom. This data was used to describe the teaching modes for which iPads are used in the sample district as well as examine if relationships exist between the four domains of teacher perceptions and the potential level of transformative integration in secondary classrooms. The findings of this study will contribute to the body of research on the integration of instructional technology (specifically one-to-one computing devices) in the classroom and help inform the technology program and professional development of the sample district.

CHAPTER 2

The purpose of this literature review was to examine what is known about one-to-one (1:1) classroom technology programs, the devices and program structures being utilized, the supports and barriers to successful implementation, teacher attitudes and beliefs about technology, and the role of 1:1 technology in student engagement and achievement. The results of the literature review reveal that, while there is evidence that successful implementation of 1:1 technology can positively impact student motivation, engagement, and achievement, factors such as teacher attitudes, structural planning, professional development, and school leadership are determinants as to whether the devices are fully and effectively integrated into daily practice. The problem is that ubiquitous access to devices is not enough to increase student achievement or drastically change the nature of classroom instruction. Teachers often utilize the devices provided in 1:1 programs as a substitute for traditional mechanisms rather than changing the way they plan curriculum, instruction, and assessment. The implementation of a 1:1 program has the potential to fundamentally alter the role of the teacher in the classroom, however a shift in teachers attitudes and beliefs about technology, coupled with effective school leadership that supports this evolution is necessary for successful implementation to occur.

History of Classroom Technology

Research is replete with information regarding how instructional technology is increasingly being integrated, and in many cases, transforming the modern classroom. In the advent of an explosive personal technology industry, it comes as no surprise that computerized devices have made their way into the the daily planning, curriculum, instruction, and assessment in schools across the world. However, teaching devices have been around longer than many realize. Mechanized teaching devices first entered the classroom as early as the mid 20th century, before the dawn of the modern digital age. B.F. Skinner, an American psychologist, behaviorist, and inventory, began experimenting with programmed “teaching machines” as early as 1954, representing one of the first forms of computer-based learning (Bates, 2014). Fast forward a few decades and it was clear that the technology revolution had its sights set on the field of education as these primitive devices evolved into a staple in American classrooms with the release of the Apple II computer in 1977 (OurICT, 2017). A year later, Apple won a contract with the Minnesota Education Computing Consortium to supply over 5,000 computers to schools across the state (Watters, 2015). With a sizeable catalogue of educational software, schools across the country quickly adopted the computer as valuable instructional tool (Buck, 2017). In 1983, Apple donated roughly $21 million worth of products to ensure that more than 9,000 elementary and secondary schools in California possessed a classroom computer (Gibian, 2017). Though the company was unsuccessful in further promoting its “Kid’s Can’t Wait” movement across the entirety of the United States, other companies such as IBM and Hewlett-Packard began piloting similar programs as it becoming increasingly clear that teachers and school leaders recognized the educational potential of these computing devices (Uston, 1983).

Since this initial inception of education computing, computers have fast become a permanent fixture in the modern classroom. According to the National Center for Educational Statistics (NCES), by 2009, 97% of American classrooms had one or more computers and 93% of classrooms had access to the Internet. Whereas the use of classroom computers initially began its use in isolated computer labs or back of the classroom stations, today technology is becoming more seamlessly integrated into day-to-day classroom routines (Soper, 2017). This progression from individual classroom computers and eventual computer labs has evolved into the present-day one-to-one (1:1) movement in which each learner is in possession of his or her own personal learning device. Clark and Lucking (2013) highlight the potential of these 1:1 devices to support collaborative learning, provide personalized learning experiences, enhance deep learning, and contribute to digitally enhanced tools for monitoring and assessment.

For policymakers and school leaders who are under constant pressure to provide increased opportunities for learning, the movement to 1:1 computing was the natural next step. Though 1:1 classroom computing was still decades away, during a 1998 speech in Denver, Colorado, Neil Postman, an American educator and author, accurately predicted the transformational power of technology indicating, “Technological change is not additive, it’s ecological”. Zimmer (2008) elaborated that “In order for us to comprehend, manage, and even embrace the rapid changes brought on by the technological advancement happening all around us, we need to understand that technology doesn’t just *add* to society — it transforms it.”

Types of 1:1 Computing Devices

The prevalence of personal computing outside the walls of the classroom has spawned a generation of learners who have grown up in a digital world and thus, not only enjoy, but expect the integration of this technology into their education. 1:1 technology initiatives have been a recent answer to these needs. Whereas in years past laptops had gained some ground as the staple of 1:1 classroom computing, their relatively high price tag renders them an unrealistic option for many school districts across America (Soper, 2017). The current frontrunners in the world of classroom technology are the Apple iPad and Google Chromebook.

Comparatively, the iPad and Chromebook perform many of the same functions. The iPad sports a more powerful processor as well as an interface that is familiar to many learners (Graham, 2018). However, as Johnson (2018) indicates, schools are often willing to sacrifice some computing power for the lower price tag of the Chromebooks. Furthermore, unlike the Chromebooks, the iPad does not include a physical keyboard so the added cost of the iPad often dissuades districts from making the added investment, thus supporting the increasing popularity of the Chromebooks for use in schools. Singer (2017) states that of the 12.6 million 1:1 devices destined for schools in the United States in 2016, Chromebooks accounted for 58 percent of the market, up from 50 percent in 2015. He further explains that "While school administrators generally like the iPad's touch screens for younger elementary school students, some said older students often needed laptops with built-in physical keyboards for writing and taking state assessment tests" (Singer, 2017).

1:1 Computing Programs in Schools

The earliest form of 1:1 computing in schools was in the form of stand-alone technology labs that offered students access to computers, printers, scanners, specialized software, and in later years, access to the World Wide Web (Poggi, 2018). At the outset, computer labs offered students access to technology that many students did not have in their homes. However, these traditional computer labs are becoming a thing of the past. As Poggi (2018) explains, "We're reaching the end of the computer lab era. This is in part due to the rise of mobile devices, and their affordability. Students carry more computing power in their pockets and wrists than any computer lab back in the 80s combined!". Furthermore, when compared to modern mobile devices, users of computer labs are often subject to constraints of availability, set time allotment, and capabilities of the machines (Paquette, 2012). While the initial financial burden of making the jump to true mobile 1:1 devices may be quite large, some districts calculate that the upkeep of mobile networks may, in fact, be less than that of maintaining a traditional computer lab (Beach, 2018). Therefore, many schools are abandoning or supplementing their computer labs with mobile 1:1 programs.

True mobile 1:1 computing programs for K-12 schools were first introduced in the United States in the late 1990s through the use of laptop computers. Shortly thereafter, Maine became the first state to launch a statewide 1:1 laptop program for all public school students (Doran & Herold, 2016). However, the provision of a device to each individual student can be very cost prohibitive and therefore, some districts have opted to employ a Bring Your Own Device ("BYOD") program in which students are allowed to use their own personal devices to take notes, collaborate on assignments, utilize the Internet, or access application (Saponaro, 2014). Despite the potential cost-savings, some schools are wary of BYOD programs given the challenges in the area of logistics (storing and charging of devices), security (protecting student information, protecting the health of the school network, and monitoring and controlling student activity), and infrastructure (network bandwidth and reliability) (K-12 Blueprint, n.d.). Chandband (2012) points out that another potential flaw of the BYOD system is that it can increase the "digital-divide" that earlier 1:1 programs were meant to eliminate.

Students should have equal access to technology with equal capabilities. Without this guarantee, many schools have looked into other options for 1:1 computing.

The “mobile lab” become a popular option for schools that felt traditional computer labs were obsolete yet were not interested in pursuing a BYOD program. In this setup, a cart with a class set of devices is shared among a number of classrooms (Grant, Ross, Wang & Potter, 2005). With the mobile lab system, there was no longer a dedicated computer teacher working in a computer lab because all teachers were expected to be proficient with the use of devices and their integration into their lessons (Computer Labs: Dead or Just Dying?, n.d.). This is not, however, a true 1:1 program as the devices are often shared among many classrooms and therefore, full integration into daily routine is not feasible (Magiera, 2012). Therefore, increasingly schools are investing in true 1:1 programs for all students. If within budget, this may be the most attractive option for schools as it ensures all users are using the same device on the school network. Compared to the many variables that the BYOD program entails, and the inconsistent availability of the mobile lab, teachers find it easier to integrate and use technology in the classroom when everyone is working on the same device in the traditional 1:1 program (Wainwright, 2013).

The Impact of 1:1 Technology on Learning, Engagement, and Achievement

Research is inconsistent in regards to whether the existence of 1:1 technology has a positive impact on student learning outcomes. In fact, many studies that aim to quantify this impact suggest very opposite results. Doran and Herold (2015) found that on average, 1:1 laptop programs had a statistically significant positive impact on student test scores in English language arts, writing, math, and science. Harris, Al-Bataineh, and Al-

Bataineh (2016) examined the effects of 1:1 technology on 4th grade achievement through the use of data collected from topic tests and the Discovery Education math assessment. The results indicated that on four of the six topic tests, students in the 1:1 classroom had scores well above those in the traditional classroom. Similar results were found on the Discovery Education math assessment in which students in the 1:1 classroom scored higher on two of three assessments.

Aside from the use of test scores as a measure of achievement in 1:1 classrooms, number of studies have examined the effect of the technology programs on students' reading and writing skills. O'Hara & Pritchard (2014) found that students classrooms in which technology was used frequently demonstrated measurable gains in basic reading tasks (main idea identification, location of supporting details, and identification of cause and effect relationships) as well as cohesion and organization of writing tasks compared to their counterparts in a non-technological control group. Furthermore, students in writing classes that employ 1:1 technology have been found to write papers that are of better quality and longer in length than their traditional classroom counterparts (Corn, Tagsold, & Patel, 2011).

Other studies suggest a only a weak correlation or no correlation between student achievement and use of technology. Warschauer (2006) suggests that 1:1 computing programs did not lead to demonstrable games in test scores when compared to those attained before implementation. Harris, Al-Bataineh, and Al-Bataineh (2016) suggest a weak correlation:

> Overall technology-based interventions tend to produce just slightly lower levels of improvement when compared with other researched interventions. The range of

> impact identified in these studies suggests that it is not whether technology is used (or not) which makes the difference, but how well the technology is used to support teaching and learning (p. 15).

Some researchers caution the use of these and similar findings when suggesting a causal relationship between 1:1 technology and positive student achievement. Higgins, Xiao and Katsipitaki (2012) suggest that effective schools and effective teachers are simply more likely to use technology than other schools or teachers being studied. Edwards (2012) explains that the use of 1:1 technology carries a certain excitement factor that may be the cause of the increased motivation and achievement rather than the benefits attained through the actual use of the devices. Similarly, students who have a greater interest in employing the use of the technology may display higher levels of knowledge due to their relevant interest in the task (Sansone et al, 2011). Furthermore, it is impossible to assign causality to the technological devices themselves as the achievement attained through their use is largely dependent on the role of the teacher. Bebel and O'Dweyer (2010) explain, "It is evident that teachers play an essential role in the effective implementation of 1:1 initiatives and that the onus of responsibility for implementation often falls to the teacher" (p. 8). Bebell and Kay (2010) concur that it is "impossible to overstate the power of individual teachers in the success or failure of 1:1 computing" (p. 47) because "teachers nearly always control how and when students access and use technology during the school day" (p. 47). Due to the many factors involved in the success of 1:1 programs, much of the literature regarding program effectiveness on student achievement remains inconclusive.

While studies present mixed findings on student achievement as a result of 1:1 implementation, most studies agree on positive changes in student motivation and engagement. Doran and Herold (2016) suggest an increase in student centered learning, engagement, and even student-teacher relationships. Clark and Lucking (2013) explain that 1:1 iPad programs, specifically, motivate and engage students by maintaining their interest in course content for longer periods of time. Kearsley and Shneiderman (1998) explain that while engaging activities that entail student-to-student interaction and employment of meaningful tasks is possible without the use of technology, the use of technology promotes a level of engagement in these activities that is difficult to achieve in its absence.

Implementing 1:1 Technology - Factors for Success

There is much literature about the potential positive effects of 1:1 technology program implementation. However, it is important to note that "successful implementation of a large-scale technology initiative requires more support and organization than just giving out equipment and a few articles on using computers in the classroom" (Murphy, King & Brown, 2007, p. 67). The provision of this technology is not enough to increase student achievement or change the nature of classroom pedagogy. Learning goals, curricula, teaching strategies, and assessments must change as well (Zucker & Light, 2009). Initial implementation must be done correctly in order for sustained success because the quality of 1:1 implementation is a large factor in student achievement. Unfortunately, many 1:1 initiatives are implemented without careful thought and can be a distraction and a waste of valuable money, time, and energy (Warschauer & Tate 2015).

In order to successfully implement a 1:1 program, school leaders must focus on three areas: program planning and leadership (policies, procedures); infrastructure planning (networks, software); and promoting teacher motivation and buy-in (Oliver, Mollet, & Corn, 2012). According to Zucker (2005) a coordinated and systematic approach to 1:1 implementation must include effective leadership and planning, a supportive school culture, training and professional development, adequate infrastructure and technical support, and access to digital content and resources. This approach must align instructional goals, educational materials, student assignments, teacher practices, and assessment techniques (Zucker & Light, 2009). They elaborate:

> Leaders must provide teachers and administrators with a clear vision of how computers are to be used; appropriate digital resources must be made available; effective, ongoing professional development needs to be provided to teachers; technical support must be available for computers, networks, printers, software, and other components; local leaders, including school principals and teacher leaders, need to be trained and supported; and so on. (Zucker & Light, 2009, p. 84).

Clark and Lucking (2013) further explain the importance of the planning phase of 1:1 implementation:

> Successful implementation of tablet technologies in schools requires careful, long- term planning before, during and after the event. Such planning involves consideration of existing technical networks, ownership models, the technology lifecycle, broad stakeholder preparation and ongoing engagement (parents,

> teachers, learners, technical managers, etc.) as well as plans for capturing progress and evaluation (p. 3).

Given the numerous factors for success, it is no surprise that implementation quality varies across schools and classrooms. In study of 21 schools with technology immersion programs, Shapley, Sheehan, Maloney & Caranikas-Walker (2010) found that a quarter or fewer of schools or core-content classrooms reached what they deemed as a "substantial" level of integration. They did, however, identify the factors that were present in those classrooms in which a 1:1 program was deemed to be substantially integrated. Administrative leadership, teacher support for innovation, quality opportunities for professional development, sufficient access to devices, access to support technicians, and support from the parents and greater community are among the leading factors for successful 1:1 program implementation (Shapley, Sheehan, Maloney & Caranikas-Walker, 2010).

A common theme in research regarding successful 1:1 implementation is the presence of a strong and sustainable professional development plan to support teacher preparation for technology use. Too often technological professional development focuses on topics of "how to" and encourages the use technology whereas the focus should be on the *integration* of technology into daily classroom practice using technology standards as the basis of action (Gupta, 2016). Grady (2011) enumerates the role of school leadership in planning and implementing effective technology professional development to include identification of teachers skills and knowledge, planning of level appropriate activities that are repeated until a level of mastery is achieved, time provided for practice and demonstration of acquired skills, and the use of teachers instructing teachers as a model for professional development.

The implementation of a 1:1 program is not sustainable without the support of all stakeholders, particularly the teachers who must be part of the planning process from its inception. Lack of teacher input from the start can negatively impact the success of a 1:1 program (Murphy, King & Brown, 2007). In order to include the teachers in all aspects of the process, Ertmer (2005) recommends the following:

> (i) Ongoing public conversations explicating stakeholders' (teachers, administrators, parents) pedagogical beliefs, including explicit discussions about the ways in which technology can support those beliefs.
>
> (ii) Small communities of practice, in which teachers jointly explore new teaching methods, tools, and beliefs, and support each other as they begin transforming classroom practice.
>
> (iii) Opportunities to observe classroom practices, including technology uses, that are supported by different pedagogical beliefs.
>
> (iv) Technology tools, introduced gradually, beginning with those that support teachers' current practices and expanding to those that support higher level goals.
>
> (v) Ongoing technical and pedagogical support as teachers develop confidence and competence with the technological tools, as well as the new instructional strategies required to implement a different set of pedagogical beliefs.

Barriers to 1:1 Technology Implementation

The appropriation of funds and purchase of devices isn't sufficient to provoke meaningful change in instructional practice and teachers lack the necessary support from school leaders to promote an effective shift in daily practice (Jones, 2017; Loschert, 2015). Even if the devices are used regularly, they are not always utilized in a manner that effectively promotes high-quality curriculum and pedagogy (Warschauer & Tate, 2015). Warschauer & Tate (2015) state that "high-quality" implementation includes technology that is tied to curriculum, a wealth of research on previously implemented 1:1 programs, a balance between micromanagement and freedom, common planning time for teachers, and investment in ample time and money spent on infrastructure to support the program and any difficulties that arise. However, a number of barriers exist the often affect this high-quality implementation of 1:1 programs. These barriers are commonly divided into the categories of internal and external. External barriers (also referred to as "first order barriers") such as availability of devices, limited access to Internet, lack of planning time, and inadequate training and support programs are among the more commonly known or visible barriers to full integration in classrooms. The process of overcoming external barriers is often beyond the control of the teacher and those teachers who do successfully navigate these barriers often do so in a way that has little effect on the way instruction is delivered. Rather, the teachers for whom external or first order barriers were previously a major hindrance to increased technology integration typically view the technology as assistive rather than transformative (Ertmer, 1999).

Internal barriers (or "second order barriers") of teacher confidence in their abilities as well as teachers' perceptions and beliefs about the value of technology can often be an even greater impediment to implementation efforts (Ertmer, Ottenbreit-leftwich, Sadik, Sendurur & Sendurur, 2013). Furthermore, teachers' beliefs about their own readiness to implement technology is also a significant factor in predicting their use of the devices (Haixia, Koehler & Wang, 2018). A more detailed account of the role of teacher attitudes and beliefs about technology can be found below.

At the onset of a new technology program (such as a 1:1 device initiative), external barriers can have a more immediate influence than these internal hurdles (Shifflet & Weilbacher, 2015). However, once these issues have been addressed, school leaders and policymakers must support teachers' pedagogical readiness and beliefs about technology so as to sustain the long-term health of the 1:1 program. In order to do so, Ertmer (2005) recommends the following:

(i) Ongoing public conversations explicating stakeholders' (teachers, administrators, parents) pedagogical beliefs, including explicit discussions about the ways in which technology can support those beliefs.

(ii) Small communities of practice, in which teachers jointly explore new teaching methods, tools, and beliefs, and support each other as they begin transforming classroom practice.

(iii) Opportunities to observe classroom practices, including technology uses, that are supported by different pedagogical beliefs.

(iv) Technology tools, introduced gradually, beginning with those that support teachers' current practices and expanding to those that support higher level goals.

(v) Ongoing technical and pedagogical support as teachers develop confidence and competence with the technological tools, as well as the new instructional strategies required to implement a different set of pedagogical beliefs.

Teachers' Attitudes and Beliefs About 1:1 Technology

Teachers beliefs influence the choices they make regarding the integration of technology and therefore can be a large factor in the success of a 1:1 program (Ertmer, 2005). The level of technological expertise of teachers has a dramatic effect on the nature of the teacher's beliefs. Teachers with little technological expertise tend to be concerned with *how* to integrate 1:1 technology into curriculum whereas more experienced users are concern themselves more with the management issues that arise as a result of this integration (Donovan, Hartley & Strudler, 2007). However, these teachers who were identified as more confident in their abilities were more likely to "be at the high end of the technology user spectrum" (Wozney, Venkatesh, & Abrami, 2006, p. 195).

On the other hand, teachers with limited technological knowledge are hesitant to incorporate the technology in a way that modifies existing practice and therefore, more frequently use technology on for functions with which they are most comfortable such as word processing or Internet searches (Donovan, Hartley & Strudler, 2007). Corn (2009) supports this notion stating that some teachers resist the full adoption of the technology because they claim to feel completely overwhelmed with having to adjust their traditional methodologies for planning and instruction. On the other hand, many teachers are able to overcome their hesitation if the perceived value of the technology for instructional use is high; if the use of technology is thought to positively impact a teacher's instructional goals, he or she is more likely to possess positive beliefs regarding moving forward with implementation (Watson, 2006). Corn, Tagsold & Patel (2011) support this notion: "Although 1:1 devices may pose implementation challenges for teachers], they believe that the use of the devices in the classroom can lead students to a more thorough understanding of content, help them complete higher-level assignments, and individualize their learning experiences".

Haixia, Koehler & Wang (2018) examined the connection between teachers' beliefs about teaching and learning and their implementation of technology. They make the distinction between traditional pedagogical beliefs (authoritative, organized, teacher-centered lessons) and constructivist beliefs (teachers facilitating students own constructivist learning). Their study found that teachers with more student-centered pedagogical beliefs employed more technology in the classroom. Corn, Tagsold & Patel (2011) refer to the reciprocal relationship between beliefs and practice stating that 1:1 initiatives impacted the role of the teacher by shifting teachers out of traditional, prescriptive roles and into more substantive ones that support self-directed learning. The pedagogical shifts that occur as a result of these initiatives are further highlighted in the study:

> Evidence from this evaluation suggests that 1:1 initiatives tend to change the learning environments and experiences teachers design; almost every aspect of the learning environment changes because teachers include more project-based learning and more opportunities for student collaboration. Teachers in the 1:1 initiatives enhanced lesson plans, redefined pedagogical approaches, and increased use of authentic learning tools and assessments (Corn, Tagsold & Patel, 2011, p.15).

It is evident that successful implementation of a 1:1 initiative, teacher beliefs and "buy-in" is critically important and therefore, school leaders must address these concerns to support sustained success of the programs (Donovan, Hartley & Strudler, 2007; Shapley, Sheehan, Maloney & Caranikas-Walker, 2010).

Relationship Between Prior Research and Present Study

This review of literature has demonstrated how instructional technology has grown exponentially since its incidence at the dawn of the digital age in the mid 20th century. In the past decade, schools have been investing great sums of money and resources into adopting and implementing full 1:1 programs, particularly through the use of Chromebooks and iPad devices. While research is mixed about the effects on student achievement, there *is* an abundance of research about the potential impact of 1:1 classroom devices to transform instruction and the classroom environment in a way that was not possible in the absence of the technology. However, a number of barriers exist that often inhibit the full, transformative potential of the devices. Research indicates that the internal barriers related to teacher perceptions about technology are among the greatest determinants of how the devices are used in the classroom and whether the learning environment and instruction are transformed through the use of the devices.

Despite heavy evidence of a correlation between teacher beliefs and technology implementation, some research suggests inconsistencies do exist between teachers' beliefs and their actual instructional use of devices (Judson, 2006; Levin & Wadmany, 2005). Teachers who self-profess to be comfortable with instructional technology and claim to believe in the value of the technology do not always utilize the devices in a way that transforms instruction. In a study of 12 teachers who had won awards for their technology use, researchers found major discrepancies between teachers' identified beliefs and their execution of the professed beliefs (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur, 2012). The study revealed that while teachers did utilize technology in their classrooms, the teachers' beliefs were not sufficient to ensure a pedagogical shift towards more student-centered learning. The findings of another qualitative case-study that utilized interviews and classroom observations to examine the relationship between beliefs and transformative integration of technology also suggest that "although teachers *believe* that technology can be used to help engage students in thinking critically to promote self-regulated learning and improve literacy skills, such beliefs do not always come to fruition in actual classroom practice" (Shifflet & Weilbacher, 2015, p. 1).

In a study of 51 teachers in a large Florida district, a researcher examined the level of technology integration, as measured by classroom observations, and its relation to various domains of teacher perceptions. While low-moderate correlations existed between the general score on the perceptions survey instrument and classroom observations, none of the domains of teacher perceptions about technology represented a statistically significant predictor of observed technology integration level (Sawyer, 2017). In discussion of her findings, the researcher indicated that despite the fact that many teachers indicated they had positive perceptions about the role of instructional technology and their comfort with implementing the technology in the classroom, 84% of teachers scored at the two lowest levels (of five) on the technology integration observation matrix, thus lending further support to the aforementioned research that indicates a contradiction in teacher perceptions versus their actual instructional practice.

Summary

This review of literature examined what is known about one-to-one (1:1) classroom technology programs, the devices and program structures being utilized, the supports and barriers to successful implementation, teacher attitudes and beliefs about technology, and the role of 1:1 technology in student engagement and achievement. Having reviewed prior research, it is clear that there is evidence that successful implementation of 1:1 technology that can positively impact student motivation, engagement, and achievement. However, factors such as teacher attitudes, structural planning, professional development, and school leadership are determinants as to whether the devices are fully and effectively integrated into daily practice. Most specifically, the internal barriers of teacher perception and beliefs having the effect of preventing any dramatic changes in the way students are taught, despite heavy investments to provide ubiquitous access to devices. Teachers often utilize the devices provided in 1:1 programs as a substitute for traditional mechanisms rather than utilizing the devices innovatively to facilitate self-directed and higher-order learning activities that are not possible in the absence of the technology.

As a result of this review of literature, this study sought to further examine this relationship between teacher perceptions of technology and their classroom practices. More specifically, the study focused on the 1:1 iPad program in the secondary classrooms of a suburban school district to investigate how the devices are being used for instruction and further examine whether teachers' beliefs and perceptions about the use of the devices correlate to higher levels for potential transformative technology integration that breaks from traditional instruction by promoting student-centered learning environments and increased opportunities for self-regulated learning.

CHAPTER 3

Research Design

The purpose of this study was to investigate how a one-to-one (1:1) iPad program is being used in secondary classrooms of a suburban school district as well as examine the relationship between teacher perceptions about technology and the integration of 1:1 technology in the classroom. In order to address the research questions related to this study, quantitative research methods were employed. More specifically, this study employed correlational-predictive measures. Correlational research is utilized to describe the relationship between variables and determine the degree to which two or more quantitative variables are related (Fraenkel, Wallen & Hyun, 2012). Furthermore, the relationships found through correlational research can be employed to make predictions. As Gay et al. (2012) explain, "If two variables are highly related, scores on one variable can be used to predict scores on the other variable" (p. 212). However, it is important to note that correlational-predictive research does not indicate causation between variables and therefore, this study will not attempt to describe the reasons for which any relationships may exist.

Data Analysis

The research questions that guide this study are:

RQ1: For what modes of instruction are 1:1 iPads being used at the secondary level of a suburban school district?

RQ2: What is the relationship between four areas of teacher technology perceptions (access to support, preparation for technology use, confidence and comfort using technology, and the perceived usefulness of instructional technology), as measured by the TUPS.

RQ3: What is the relationship between teachers' perceptions about technology and average frequency of use of iPads across a variety of teaching modes (as measured by the TUPS)?

RQ4: What is the relationship between teachers' perceptions about technology (as measured by the TUPS) and level of potential transformative technology integration (as measured by the TIM-R) controlling for total years teaching, total years teaching in a 1:1 classroom, average number of students per class, and subject area taught

To examine research question 1, descriptive statistics were compiled from the Technology Uses and Perceptions Survey to illustrate the instructional modes that participants indicated as most frequently employed in their classroom as a result of their use of iPads. Furthermore, a full bivariate correlation matrix was constructed to examine if any relationships existed between the use of each of the 16 modes of instruction for which iPads were utilized.

To address research question 2, a full bivariate correlation matrix was created to examine if any relationship existed between each of the domains of perceptions of the TUPS, thus allowing the researcher to address any potential multicollinearity.

To address research question 3, the average frequency of use of the iPads across 16 different teaching modes was constructed and correlated to each of the four domains of perceptions of the TUPS.

To address research question 4, the average composite scores from each of the areas of the TUPS (technology access & support, preparation for technology use, perceptions of technology use, confidence and comfort using technology) were constructed and correlated to each participant's composite TIM-R score.

Participants

The population for this study comprises secondary teachers from the Graceville Public Schools, a pseudonym for a suburban district in Nassau County, New York. The district has five secondary schools - two high schools, two middle schools, and one alternative high school. Demographic information for student population and faculty members are found on the table 1.1 (from *Public School Review*) and participant information is found on table 1.2.

Table 1.1: Demographics of Sample School District

	Number of Students	Number of Teachers
1. High School A	1,124	102
2. High School B	1,193	112
3. Middle School A	771	74
4. Middle School B	777	76
5. Alternative High School	37	6

Table 1.2: Study Population

	Number of Participants	% Study Total
1. High School A	30	31.9
2. High School B	15	16.0
3. Middle School A	18	19.1
4. Middle School B	29	30.9
5. Alternative High School	2	2.1

The sample of this study comprised 94 teachers from the Graceville secondary schools. After receiving approval from district and building level administration, volunteers were solicited via an email blast sent out to all faculty of the secondary buildings of the Graceville Public Schools (see teacher participation letter in Appendix G) Teachers were informed that only criterion for participation is that they and their students utilize the one-to-one iPad program as part of instruction. No minimum level of iPad skill or competency was required to participate in this study. Teachers who responded to the initial email were then provided more detailed instructions about how to access the survey instrument (for more information, refer to the "Procedures" section).

After the initial email was sent to solicit volunteers for the study, 82 teachers responded indicating interest in participating in the study. Three volunteers had to be graciously turned away due to not holding an instructional role that utilizes the iPad (guidance counselors, paraprofessionals, etc). A week later, a second email was sent to solicit additional volunteers. 60 additional faculty members volunteered to participate, bringing the total number of volunteers to 142. However, it is important to note the distinction between “volunteers” and “participants” as not all of the initial volunteers completed the survey instruments. As a correlational-predictive study, only teachers who complete both the TUPS survey and TIM-O matrix are included in data analysis. As a result, the total number of participants in this study whose responses were utilized for data analyses was 94.

Instruments

This study utilizes the Technology Integration Matrix and (TIM) Technology Uses and Perceptions Survey (TUPS). Both instruments were developed by the Florida Center for Instructional Technology (FCIT) at the University of South Florida. Access to and use of the instruments are available to schools and educational researchers for purchase via yearly subscription. According to the terms and conditions of FCIT’s TIM Tools, once paid in full, the school/district (or researcher, in this case) is granted a non-exclusive license to use the TIM Tools product which expires one year after the date of purchase. Therefore, upon receipt of TIM Tools license, no further permissions are required of the researcher to utilize the instruments. The cost to access the TIM suite of survey instruments depends on the number of active participants the researcher chooses to have at any given time. During a pilot study, the researcher purchased a subscription that allowed for up to 50 active participants at the cost of $500. Upon beginning further data collection, the researcher deactivated all of the pilot study users so that their responses would not interfere with analyses of new responses. There was an upcharge of $200 to upgrade to the next subscription tier that allows for up to 100 active participants, however this price was prorated to $136 because the upgrade was purchased in the middle of the yearlong subscription. Finally, after more volunteers than initially anticipated came forward, the researcher again requested an invoice to upgrade to a tier 3 subscription that allows for up to 200 active participants. Kindly, the representatives from the Florida Center for Instructional Technology gifted the researcher the tier 3 subscription at no cost. Therefore, the total cost to utilize the survey instruments for the period of one year was $636. Though the TIM suite subscription offers five different survey instruments, this particular study makes use of just two, the Technology Integration Matrix (TIM) and the Technology Uses and Perceptions Survey (TUPS).

Technology Integration Matrix

The TIM was created in 2006 as a comprehensive framework for evaluating the integration of instructional technology in the classroom. In 2011, the matrix was updated with more specific indicators of teacher behaviors, student behaviors, and various components of the learning environment (Welsch, Harmes, & Winkelman, 2011). The TIM describes five interdependent characteristics of the learning environment: active, constructive, goal-directed, authentic, and collaborative. Each of these characteristics associated with five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. Each level is marked with a number (denoted as dots on the table), indicating increased integration of technology. As a whole, these five learning environments and levels of technology integration form a 25 cell matrix (see Appendix B).

Welsch, Harmes, and Winkelman (2011) discuss the complexity of properly assessing a teacher's technology integration in a given lesson. They explain: "Evaluating the use of technology within a given lesson is a complex task. TIM defines descriptors for student activity, teacher activity, and the setting for each level of technology integration.

It breaks down the complexity so that educators can apply a practical understanding of the attributes of effective teaching to technology integration". The FCIT web page offers downloadable tables of extended teacher, students, and learning environment descriptors that facilitate an observer or self-reflective teacher's selection of appropriate cell on the TIM. The basic descriptor for the 5 levels of technology integration, as indicated on the matrix, are Entry (the teacher begins to use technology tools to deliver curriculum content to student), Adoption (the teacher directs students in the conventional and procedural use of technology tools), Adaptation, (the teacher facilitates the students' exploration and independent use of technology tools), Infusion, (the teacher provides the learning context and the students choose the technology tools), and Transformation (the teacher encourages the innovation the innovative use of technology tools to facilitate higher-order learning activities that may not be without the use of technology).

Ruman & Prakasha (2017) suggests that major shifts in the attitudes of both teachers and students can be seen in schools and classrooms that utilize the TIM as part of teacher planning and evaluation of teachers by school leaders:

1. Teacher-centered classroom to Student-centered classroom: The entry-level lessons are teacher-centric and as the level moves up to the transformation-level, it becomes more of student-centric where the students adopt new information, infuse it to select their choices and make decisions. Thus making the transformation level more of a student-centric. The students are let free to create their own versions of the solution in the form of videos, websites, audio, podcast etc.

2.Procedural understanding to conceptual understanding: This can be thought of as the Blooms taxonomy where the students use their higher order thinking skills. At the entry level, the students simply understand the content at a very basic level, but the students will develop higher order thinking skills and will be able to apply their knowledge in new situations.

3. The conventional use of technology tools to complex use of technology tools: At the entry level, the teacher has the control on the technological resources accessed by the students, but at the transformation level, the student chooses the type of technology tool he wishes to. Students have an opportunity to connect to the outside world digitally (Ruman & Prakasha, 2017, p. 25).

While the TIM-O is a version of the matrix typically used as a tool for observers to evaluate the level of technology integration in a given lesson, the FCIT also offers the TIM-R, or Technology Integration Matrix Reflection, designed to guide a teacher through the process of evaluating the level of technology integration within their own classroom during a particular lesson. This study utilized the TIM-R. Participants were asked to reflect on and evaluate the technology integration of a particular lesson that demonstrates their highest technology integration *potential.* The observation or reflection of an individual lesson is not a meaningful indicator of typical level of technology integration, and therefore, this study will focus on the relationship between teacher perceptions of technology and a teacher's *potential* level of technology integration.

Technology Uses and Perceptions Survey

This correlational-predictive study examined the relationship between the level of potential technology integration (as measured by the TIM-R) and teachers' perceptions about technology. Data on these technological perceptions were collected with the Technological Uses and Perceptions Survey (TUPS), another tool offered to subscribers of FCIT's TIM tools. The FCIT's webpage offers the following description about the TUPS:

> The Technology Uses and Perceptions Survey provides essential information about the current teacher use and perceptions of technology. The results can be used to collect baseline data for special initiatives, inform technology purchase decisions, identify professional development needs, and facilitate coaching in the use of instructional technology. The TUPS looks at what teachers believe about the role of technology in the classroom, as well as their comfort and confidence with technology in general, with pedagogy of technology, with a variety of different specific technologies, and it also asks about the frequency that they use those technologies and the frequency with which their students use those technologies. The survey includes 200 items in seven categories and provides valuable data to guide school- and district-level decision-making (n.d.).

The TUPS instrument allows the researcher to select only the specific categories and questions within each category to present to the participants. This study will focus on four of the TUPS survey categories and their relationship to potential level of technology integration in the classroom: technology access and support, preparation for technology use, perceptions of technology use, and confidence and comfort using technology. In each category, the survey utilized a number of statements about technology to which the participants respond via a Likert scale. Responses to the preparation items are provided on a 5-point Likert-type frequency scale (ranging from not at all to entirely). Responses to the confidence and comfort and general school support items are provided on a 5-point Likert-type scale (ranging from strongly disagree to strongly agree). Responses to access and support as well as attitudes toward technology use are reported on a 5-point Likert-type scale (ranging from strongly disagree to strongly agree).

Finally, the TIM tools ask each respondent to complete a demographics survey that includes questions on gender, average number of students per class, total years of teaching experience, years utilizing technology for instruction, subject area(s) taught, and grade level(s) taught. Responses to these demographic questions provide additional independent variables for analysis in this study.

Both the TIM-R and the TUPS were electronically administered. Each participant was assigned a unique username and password (for the sake of anonymized data, the usernames are labeled as "Pipala1", "Pipala2", etc). Data is aggregated on the online system and available for download to the researcher in various formats (.xls, SPSS, raw data).

Validity of the Instrumentation

The original version of the survey instrument that became known as the TUPS consisted of four of the current seven domains: integration, confidence and comfort, access and support, and attitudes and beliefs. According to Hogarty, Lang and Kromrey (2003), each domain was examined for comprehensiveness and reviewed by content experts prior to a pilot study with a number of graduate students, many of whom were in-service teachers. After further revisions were made, the instrument was field tested in a large districted composed of 16 high schools, 23 middle schools, and 82 elementary schools. After field testing was complete, researchers were better able to examine the validity of the survey instrument. Hogarty, Lang and Kromrey (2003) explain:

> Multiple sources of evidence were examined with regard to the construct validity of scores derived from the survey. Exploratory factor analysis was conducted within each section of the instrument, and the composite scores showed acceptable levels of reliability (with coefficient alpha ranging from .74 to .92). Furthermore, relationships between instrument subscales and relationships with external variables provide some initial support for the validity of the scores (p. 158).

To measure the internal consistency of the TUPS instrument, the researcher ran the Cronbach's alpha test using IBM SPSS. The Cronbach's Alpha value for the the four domains of perceptions of the TUPS was .922. According to George and Mallery (2003), a Chronbach Alpha level of greater than .9 signifies excellent internal consistency of the instrument.

Specific studies on the validity of the The Technology Integration Matrix are not available. However, given the fact that measurement via a rubric or matrix (whether by an observer or as a self-reflective exercise) can be inconsistent due to subjectivity, the creators of the TIM aim to increase reliability of response data through the use of detailed descriptors of teacher, student, and setting. These descriptors are available as .pdf downloads via the TIM webpage or are an expandable cell on the electronic version of the TIM. Furthermore, according to Welsch, Harmes, and Winkelman (2011), within each cell of the electronic matrix, a user can find links to four classroom technology tips videos—one each in math, science, language arts, and social studies. These videos were recorded to demonstrate concrete examples of technology integration different teaching profiles. A teacher who is struggling with the how and why of technology integration can see examples of lessons (with accompanying lesson plans) in which students use technology and hear explanations directly from his or her peers. These videos purportedly serve as an added measure to ensure TIM users are best able to select the cells on the matrix that appropriately describe the level of potential technology integration in the classroom.

Another option available to researchers and participants who are completing the TIM is the use of a series of skip-logic questions about a specific lesson. The questions serve as a means of completing the TIM rubric without the need to be well-trained in its use nor familiar with the specific language that differentiates each column (or technology level descriptors). Participants in this study were instructed to select this "Question-Based" option for completing the TIM-R as a means of decreasing the potential level of subjectivity or skewed data that may result from allowing users to self-select their own TIM indicators. Furthermore, utilizing the question-based option assures that each participant's TIM instrument is completed, whereas the self-select option leaves the possibility that some indicators would remain incomplete, thus requiring the researcher to discard that user's data set for the sake of consistency in data analyses.

To measure the internal consistency of the TIM-R instrument, the researcher ran the Cronbach's alpha test using IBM SPSS. The Cronbach's Alpha value for the 5 classroom environments of the TIM-R was .871. According to George and Mallery (2003), these results indicate very good internal consistency of the instrument.

Procedure

In order to collect data for this study, in accordance with the regulations of the university's Institutional Review Board (IRB), the researcher completed the National Institutes of Health Office of Extramural Research's Protecting Human Research Participants course (see completion certificate in Appendix A). Upon IRB approval, the researcher requested and obtained permission from the Assistant Superintendent for Secondary Education of the district from which secondary teacher participants were acquired (see permission and approval letters in Appendices E and H) as well as the principals of each of the secondary schools (see permission and approval letters in Appendices F and I).

Convenience sampling was employed in this study based on the researcher's ability to reach the sample population. According to Henry (1990), convenience sampling is frequently utilized in research due to the speed and ease of data collection, access to participants, and cost effectiveness. For this study, all secondary teachers within the sample district were sent an email soliciting volunteer participation in the study. The only criterion mentioned in the teacher participation letter (see Appendix G) was that the teacher and their students utilize the iPad for instruction. No level of perceived competency or use was required for participation in the study. Teachers who indicate interest in participating in the study were sent a username and password to access the TIM Tools site as well as a link to a document created by the researcher with detailed instructions on accessing and completing the TIM-R and TUPS instruments (see

Appendix D). As previously mentioned, a second email was sent a week after the initial message to solicit further volunteers.

The TIM Tools website allows the study administrator to customize and manage the instrument (other tools are available for use, however for the purpose of this study, they have been hidden from the view of participants to facilitate ease of use). The researcher created a user profiles on the TIM system equal to the number of study volunteers. The numeric usernames and passwords did not contain any identifiable information about the participants (specific names, personal email addresses, etc. are not required for login). All login information followed the same format, pipala1@stjohns.edu / pipala1, for usernames and passwords, respectively (note: the system requires the username to be in the format of an email address, even though none of the usernames provided are active email accounts).

In order to access the results from the TIM-R and TUPS instruments, the researcher utilized the TIM admin center to download the raw data from each instrument into an Excel spreadsheets. Of the 142 initial volunteers, 100 people logged in to the survey instruments. For the purpose of data cleaning, the responses from any user who did not complete *both* the TIM-R and the TUPS were removed prior to data analyses. Furthermore, any user who started by did not complete the entire TUPS instrument was also removed from the data set (given the question-based format of the TIM-R, there were no incomplete TIM-R matrices to remove). For these reasons, the data from 6 participants were removed. Therefore, the total number of participants from whom useable data was acquired was 94. Once cleaned, both TUPS and TIM-R data sheets were uploaded to IBM SPSS for data analysis.

CHAPTER 4

The purpose of this study was to determine how 1:1 iPad technology was being utilized at the secondary level of a suburban school district as well as examine the relationship between various teacher perceptions about technology and the potential level of technology integration in the classroom. Usable data were obtained from 94 participants. Demographic information for these participants is found on Table 2.1.

Table 2.1. Participant Demographic Information

Factor	N	% of Total
Gender		
Male	35	37.2
Female	59	62.8
Degree		
Bachelors	4	4.3
Masters	78	83.0
Doctorate	8	8.5
Other	4	4.3
Subject Taught		
Foreign Language	15	16.0
ESOL	6	6.4
Social Studies	10	10.6
English	13	13.8
Math	13	13.8
Science	11	11.7
Art / Music	5	5.3
Special Education	8	8.5

Other	6	6.4
Interdisciplinary	7	7.4
Total Teaching Experience		
1-5 years	13	13.8
6-10 years	24	25.5
11-15 years	23	24.5
16-20 years	16	17.0
21-25 years	14	14.9
26+ years	4	4.3
Average Number of Students		
1-5 years	5	5.3
6-10 years	11	11.7
11-15 years	7	7.4
16-20 years	18	19.1
21-25 years	37	39.4
26+ years	16	17.0

The demographic factor of "number of years teaching with technology" was removed from analysis due to the fact that many participants erroneously listed values that exceed the longevity of the sample district's 1:1 iPad program as well as some values that exceed the existence of the iPad device. While these values may offer insight into the role of instructional technology in general, they have been removed due to the fact that they do not offer insight into the specific iPad-based focus of this study.

The results of the study are outlined below for each research question.

Research question 1: For what modes of classroom instruction are iPads being used at the secondary level?

Teachers utilized the TUPS to indicate how often they utilized the iPad for each of the following teaching modes: small group instruction, individual instruction, cooperative groups, independent learning, flipped learning, as a reward, tutoring or remediation, as a student research tool, for student planning and managing projects, as a productivity tool for instruction (taking notes, completing assignments, grading student work, etc.), as a student presentational tool, for student discussion, for instructional delivery (for example, iPad mirroring), as a communication tool (for example, email or Google Classroom), to create new instructional content for students, and as a means of assessing learning. The TUPS used a Likert scale from 0-5 to indicate how often the iPad was used in each instructional mode (1 = not at all, 2 = once per month or less, 3 = once per week, 4 = several times per week, 5 = every day, 6 = multiple times per day).

The results of the survey, found on Table 3.1, indicate that teachers utilize the iPads most frequently as a communication tool *(M = 5.21, SD = 0.891).* On the TUPS, communication tool was defined as using the iPad for email, Google Classroom posts, and electronic discussion. 45.7% of respondents indicated they use the iPad multiple times a day as a communication tool, 80.8% of respondents indicated using it at least once per day, and 95.7% at least several times per week.

The second most frequent use of the iPad was as a productivity tool (*M = 4.78, SD = 1.128)*. Productivity tool was defined as using the iPad to manage workflow (taking notes, completing assignments, and grading/returning student work). 24.5% of respondents reported using the iPad as a productivity tool multiple times a day, 71.3% reported using it at least once a day, and 90.4% reported using it several times per week.

The third most frequent use of the iPad was for independent learning in school or at home (*M = 4.38, SD = 1.279)*. Independent learning is defined as teacher-guided, but student driven learning through independent inquiry. 21.3% of respondents indicated they used the iPad for independent learning multiple times a day, 49% use if at least once a day, and 80.9% indicate it is used for independent learning several times a week.

The next most frequent uses of the iPad was for individualized instruction *(M = 4.18, SD = 1.336)*, the creation of content *(M = 4.18, SD = 1.336),* and delivering instruction *(M = 4.16, SD = 1.575).* Individualized instruction is defined as teacher driven instruction delivered to students on an individual basis through the use of the iPad. 14.9% of respondents indicated they used the iPad for individualized instruction multiple times a day, 47.9% use if at least once a day, and 72.4% indicate it is used for individualized instruction several times a week. 20.2% of respondents indicated they used the iPad for creating content multiple times a day, 50% use if at least once a day, and 73.4% indicate it is used for creating content several times a week. 22.3% of respondents indicated they used the iPad for delivering instruction multiple times a day, 50% use if at least once a day, and 71.3% indicate it is used for creating content several times a week.

Outside of these top five uses, the remaining uses of the iPad, as indicated by teachers on the TUPS were for student collaboration and cooperative learning *(M = 3.79, SD = 1.227)*, for student discussion and communication *(M = 3.78, SD = 1.385*), small group learning *(M = 3.72, SD = 1.371*), as a means of assessment *(M = 3.71, SD = 1.507)*, as a research tool (*M = 3.63, SD = 1.376*), for student projects (*M = 3.41, SD =*

1.447), as a student presentational tool *(M = 3.31, SD = 1.376*), for tutoring or remediation (*M = 2.62, SD = 1.518)*, for flipped learning (*M = 2.34, SD = 1.258*) and as a reward *(M = 1.81, SD = 1.238)*.

Of these least frequent instructional modes for which the iPad is used 64.9% of teachers indicate using the iPad for tutoring or remediation once per week or less with 39.4% indicating it is never used for this purpose in their classroom. 79.8% of teachers indicate they use the iPad for flipped learning one time per week or less and 27.7% indicate not using it at all for this purpose. Finally, 87.2% of teachers indicate they use the iPad as a reward once per week or less while 60.6% indicate not using it as a reward at all.

Table 3.1. Minimum and Maximum Response, Means and Standard Deviations for TUPS Responses to iPad Teaching Modes

	N	M	SD
Communication tool	94	5.21	0.891
Productivity tool	94	4.78	1.128
Independent learning	94	4.38	1.279
Individualized instruction	94	4.18	1.336
Creation of content	94	4.18	1.51
Delivering instruction	94	4.16	1.575
Collaboration / cooperative	94	3.79	1.227
Discussion / communication	94	3.78	1.385
Small group learning	94	3.72	1.371
Means of assessment	94	3.71	1.507
Research tool	94	3.63	1.376

Student projects	94	3.41	1.447
Student presentations	94	3.31	1.376
Tutor / remediation	94	2.62	1.518
Flipped learning	94	2.34	1.258

Statistically significant correlations existed between many of these modes of instruction for which iPads were used. This positive relationship implies that as a participant more frequently utilized the iPads for one mode of instruction, they also increased the frequency of use of the iPad for the other modes with which it is positively related. Refer Table 3.2 for the full correlation matrix.

Table 3.2. Pearson Correlation Among Instructional Modes Using iPads

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Sm. Group Instruction	-															
2. Individual Instruction	.556**	-														
3. Collaboration / Cooperative Learning	.500**	.300**	-													
4. Independent Learning	.374**	.381**	.373**	-												
5. Flipped Instruction	.398**	.193	.353**	.205*	-											
6. As a Reward	.311**	.171	.355**	.189	.429**	-										
7. Tutoring / Remediation	.269**	.172	.107	.436**	.294**	.355**	-									
8. Research Tool	.287**	.166	.230*	.192	.223*	.191	.328**	-								
9. Student Projects	.270**	.155	.327**	.105	.193	.153	.186	.732**	-							
10. Productivity Tool	.189	.348**	.176	.298**	.092	-.116	.257*	.202	.150	-						
11. Student Presentations	.285**	.186	.362**	.238*	.212*	.218*	.279**	.556**	.551**	.239*	-					
12. Student Discussion / Communication	.505**	.208*	.550**	.413**	.334**	.307**	.251*	.317**	.444**	.188	.488**	-				
13. Delivering Instruction	.285**	.288**	.348**	.428**	.103	.121	.242*	.058	.056	.347**	.255*	.460**	-			
14. Communication Tool	.339**	.302**	.381**	.362**	.194	.125	.236*	.136	.073	.508**	.174	.301**	.420**	-		
15. Creation of Content	.362**	.533**	.277**	.387**	.239	.220*	.336**	.110	/019	.365**	.309**	/385**	.555**	.507**	--	
16. Means of Assessment	.232*	.277**	.459**	.387**	.313**	.276**	.266**	.368**	.307**	.234*	.448**	.438**	.382**	.286**	.401**	-

* * Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Research question 2: What is the relationship between four areas of teacher technology perceptions (access to support, preparation for technology use, confidence and comfort using technology, and the perceived usefulness of instructional technology), as measured by the TUPS.

Teachers used the TUPS to answer Likert scale questions about their perceived comfort using 1:1 iPad technology, their perceptions about the use of iPad technology, their perceived preparation for technology use, and their perceived level of technological support in their school and district (specifically in regards to access to, interaction with, and benefits obtained from district and school-based technology specialists and professional development opportunities). Answers to each of these sections were compiled into a composite score. Finally, an average was calculated from each of these composite scores considering that each section of the TUPS did not contain an identical number of items.

The results of a Pearson correlation, found on Table 4.1, indicate a statistically significant relationship between perceived support and perceived preparation *($r = .346$, $p = .001$)*, perceptions about technology and perceived preparation (*$r = .382$, $p = .001$)*, perceived preparation and perceived comfort (*$r = .263$, $p = .011$),* and between perceptions about technology and perceived level of comfort with technology (*$r = .550$, $p = .001$*). There was no statistical significance at the .05 level between the domains of perceived support and perceptions about technology (*$r = .148$, $p = .155$)*, and perceived support and perceived comfort (*$r = .200$, $p = .053$).*

Table 4.1. Pearson Correlation Among Domains of TUPS

	1	2	3	4
1. Perceived Support	-	.346**	.148	.200
2. Perceived Preparation	.346**	-	.382**	.263*
3. Perception of Tech.	.148	.382**	-	.550**
4. Perceived Comfort	.200	.263*	.550**	-

* * Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Research Question 3: What is the relationship between teachers' perceptions about technology and average frequency of use of iPads across a variety of teaching modes (as measured by the TUPS)?

The results of a Pearson correlation, found on Table 5.1, indicate a statistically significant relationship between all four areas of teacher perceptions and average frequency of use of iPads across 16 different teaching modes. A negative correlation exists between perceived support and average frequency of iPad use, $r(92) = -.235$, $p = .023$. Teachers who perceived themselves as being supported by technology specialists in their school also reported employing iPads less frequently across a variety of teaching modes. A strong positive correlation exists between perceived preparation and average frequency of iPad use, $r(92) = .515$, $p < .001$. Teachers who perceived themselves as being prepared to integrate iPads into their classroom instruction also reported employing iPads more frequently across a variety of teaching modes. A strong positive correlation exists between perceptions about technology and average frequency of iPad use, $r(92) =$

.544, $p < .001$. Teachers who perceived iPad technology as beneficial to teaching and learning also reported employing iPads more frequently across a variety of teaching modes. A strong positive correlation exists between perceived comfort and average frequency of iPad use, $r(92) = .573$, $p < .001$. Teachers who perceived themselves as feeling comfortable with using the iPad for instruction also reported employing iPads more frequently across a variety of teaching modes.

Table 5.1. Pearson Correlation Among Domains of TUPS and Average Frequency of iPad Use

	1	2	3	4	5
1. Perceived Support	-	.346**	.148	.200	-.161
2. Perceived Preparation	.346**	-	.382**	.263*	.114
3. Perception of Tech.	.148	.382**	-	.550**	-.046
4. Perceived Comfort	.200	.263*	.550**	-	.030
5. Avg Frequency of Use	-.235*	.515**	.544**	.573**	-

* * Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Research Question 4: What is the relationship between teachers' perceptions about technology (as measured by the TUPS) and level of potential transformative technology integration (as measured by the TIM-R) controlling for gender, highest degree obtained, subject taught, total years teaching, and average number of students per class.

The average scores of the four sections of the TUPS (comfort, perceptions, preparation, and support) were correlated with the composite score from the TIM-R matrix which quantified the potential level of transformative technology integration in the classroom (Entry = 1, Adoption = 2, Adaptation = 3, Infusion = 4, Transformation = 5) for each of five classroom environments (Active, Collaborative, Constructive, Authentic, Goal-Directed).

The results of a Pearson correlation, found on Table 6.1, do not indicate any statistically significant relationships between the four domains of the TUPS and the potential level of transformative technology integration.

Table 6.1. Pearson Correlation Among Domains of TUPS and TIM-R Composite Score

	TIM-R Composite
1. Perceived Support	-.161
2. Perceived Preparation	.114
3. Perception of Tech.	-.046
4. Perceived Comfort	.030

* * Correlation is significant at the 0.01 level (2-tailed)
*   Correlation is significant at the 0.05 level (2-tailed)

The maximum score attainable on the TIM-R composite (that measures the potential level of technology integration across 5 classroom learning environments) was 25. Of the 94 participants, the average score was 13 (*M = 13.30, SD = 4.583).* Within each classroom environment, the maximum attainable score was 5. The mean scores for each classroom environment are found on Table 6.2.

Table 6.2. Mean and Standard Deviation Scores of TIM-R Classroom Environments

	N	Min	Max	M	SD
Active	94	1	5	2.77	.977
Collaborative	94	1	5	2.50	1.207
Constructive	94	1	5	2.70	1.025
Authentic	94	1	5	2.79	1.269
Goal-Directed	94	1	5	2.54	1.142

Despite no significant correlations being found between the domains of teacher perceptions (as measured by the TUPS) and the potential level of transformative technology integration, further analyses were performed to determine whether any statistical differences exist among the mean TIM-R scores of demographic factors: gender, highest degree obtained, subject taught, number of years teaching, and average number of students in a class. As previously mentioned, the demographic factor of "number of years teaching with technology" was removed from analysis due to erroneously listed values.

Gender

An independent samples T-test was performed to determine if any significant difference in mean TIM-R scores existed between genders. Results of the test, found on Table 6.3, indicate no significant difference $t(92) = .583$, $p = .561$, exists between males ($M = 13.66, SD = 4.385$) and females ($M = 13.08, SD = 4.721$).

Table 6.3. Comparison of Mean TIM-R Scores by Gender

Gender	N	M	SD
Male	35	13.66	4.385
Female	59	13.08	4.721

Highest Degree Obtained

A one-way ANOVA was performed to determine if any significant difference in mean TIM-R scores existed between participants' highest degree attained. Results of the test, found on Table 6.4, indicate no significant effect of highest degree earned on TIM-R composite score at the $p<.05$ level for the three conditions [$F(3, 90) = .657$, $p = .581$].

Table 6.4. Comparison of Mean TIM-R Scores by Highest Degree Obtained

Degree Obtained	N	M	SD
Other	4	11.75	3.304
Bachelors	4	13.00	4.830
Masters	78	13.58	4.752
Doctorate	8	11.50	3.162

Subject Taught

A one-way ANOVA was performed to determine if any significant difference in mean TIM-R scores existed between participants' subject taught. Results of the test, found on Table 6.5, indicate no significant effect of subject taught on TIM-R composite score at the $p<.05$ level for the three conditions [$F(11, 82) = 1.189$, $p = .308$].

Table 6.5. Comparison of Mean TIM-R Scores by Subject Taught

Subject Taught	N	M	SD
Foreign Language	15	14.67	4.562
ESOL	6	14.67	6.121
Social Studies	10	14.20	3.967
English	13	15.38	6.185
Math	13	12.92	3.303
Science	11	12.00	5.215
Art / Music	5	11.20	3.493
Special Education	8	10.63	2.875
Other	6	15.00	1.633
Interdisciplinary	7	11.14	2.968

Total Years Teaching

A one-way ANOVA was performed to determine if any significant difference in mean TIM-R scores existed between participants' total years of teaching. Results of the test, found on Table 6.6, indicate no significant effect of total years teaching on TIM-R composite score at the $p<.05$ level for the three conditions [$F(5, 88) = 2.098$ $p = .073$].

Table 6.6. Comparison of Mean TIM-R Scores by Total Years Teaching

Total Years Teaching	N	M	SD
1-5 years	13	10.54	3.711
6-10 years	24	14.21	4.549
11-15 years	23	12.43	3.941

16-20 years	16	15.25	5.710
21-25 years	14	13.86	4.111
26+ years	4	12.00	4.243

Average Number of Students Per Class

A one-way ANOVA was performed to determine if any significant difference in mean TIM-R scores existed between participants' average number of students per class. Results of the test, found on Table 6.7, indicate no significant effect of average number of students on TIM-R composite score at the p<.05 level for the three conditions [F(5, 88) = 1.088, p = .373].

Table 6.7. Comparison of Mean TIM-R Scores by Average Students Per Class

Total Years Teaching	N	M	SD
1-5 students	5	11.00	3.464
6-10 students	11	10.91	4.636
11-15 students	7	14.57	2.507
16-20 students	18	13.61	4.565
21-25 students	37	13.84	4.233
26+ students	16	13.50	6.000

Summary

This chapter provides an analysis of the data collected from the Technology Uses and Perceptions Survey (TUPS) and Technology Integration Matrix Reflection (TIM-R) survey instruments. The results were compiled from 94 responses from teachers in the Graceville Public Schools, a pseudonym for a suburban district in Nassau County, NY.

The data gathered in this study were analyzed using IBM SPSS to determine how one-to-one iPads are used for instructional modes at the secondary level and examine if a relationship exists between various teacher beliefs about technology and the potential for transformative integration of iPads into instruction. Results of data analysis indicate that teachers most frequently use the iPads as a communication and productivity tool as well as for independent learning. Four independent variables were considered as potential determinants of the potential level of technology integration. These variables were teachers' perceived level of support, perceived comfort using 1:1 technology, ideas and perceptions about the technology itself, and perceived preparation for technology use. Among these variables, significant relationships existed between perceived support and perceived preparation, perceptions about technology and perceived preparation, perceived preparation and perceived comfort, and between perceptions about technology and perceived level of comfort with technology. This implies that participants who perceived themselves as being supported by a technology specialist also felt better prepared to integrate iPads in their instruction. Participants who perceived technology as beneficial to teaching nad learning also felt better prepared to integrate the technology and comfortable using the technology in their classrooms. Participants who felt better prepared to integrate the technology also were more comfortable with its use. However, there were no significant relationships between any of these variables and participants' scores on the TIM-R, which measures their potential level for transformative technology integration. This implies that despite participants having positive perceptions about the benefits of technology, feeling supported, feeling comfortable with technology use, and prepared to integrate technology in their classrooms, there was no significant transformations in classroom instruction with regards to promoting self-directed, cooperative learning that promotes higher-order thinking activities.

CHAPTER 5

Interpretation of Results and Relationship to Prior Research

Prior research suggested that ubiquitous access to technological devices were not enough to increase student achievement nor drastically change the nature of classroom instruction as the devices were used as a replacement for traditional practice rather than as a means of transforming the way teaching and learning occurs in the classroom (Loschert, 2015). Internal barriers (or "second order barriers") of teacher confidence in their abilities as well as teachers' perceptions and beliefs about the value of technology were often cited as one of the leading reasons for which teachers are not achieving higher levels of transformative integration of the devices (Ertmer, Ottenbreit-leftwich, Sadik, Sendurur & Sendurur, 2013). For this reason, this study set out to determine how iPads were being used for instruction at the secondary level of a suburban school district and to examine whether a relationship existed between teacher perceptions and beliefs about technology and the potential level of technology integration in the classroom.

According to the data from research question 1, teachers in the Graceville Public Schools *were* using the iPad devices consistently and for a variety of instructional modes. On average, they were used for communication (Google Classroom, email) at least once per day, with many participants indicating they use the iPad for this purpose multiple times per day. Five other uses (productivity tool, independent learning, individualized instruction, content creation, and for delivery of instruction) scored an average response of at least "several times per week". An additional four (collaboration/cooperation, student discussion/communication, small group learning, assessment, and as a research tool) have scores that round up to that several times per week mark. Using the iPad for student projects, presentations, and as a tool for remediation average a response of "once a week", whereas only one area, "as a reward" was below this level of average frequency. This represents an *enormous* amount of time that the devices were being utilized for quite varied uses at the secondary level. The sample district invests millions of dollars each year in the renewal of leases for the 1:1 iPad program. According to the data collected, it is clear that this investment has led to significant use of the distributed devices at the secondary level.

Research question 3 examined the relationship between the four domains of teacher perceptions from the TUPS (perceived support, perceived preparation, perceived comfort, and perceived usefulness of technology) and average frequency of iPad use across 16 different teaching modes. A moderate to strong relationship existed between all four of the domains and the average frequency of use. This demonstrates how increases in perceived value as well as increased levels of comfort and preparation positively relate to how iPads are being used for instruction. Teachers in the sample district were using the iPads for a variety of purposes and in many cases, quite frequently. These findings were consistent with prior research that found that teachers who were identified as more confident and comfortable in their abilities were more likely to be high end technology users (Wozney, Venkatesh, & Abrami, 2006). Watson (2006) furthered this notion stating that if the use of technology is thought to positively impact a teacher's instructional goals, he or she is more likely to possess positive beliefs regarding moving forward with increased implementation. However, this research and the data from research questions 1 and 3 only confirmed the increased *use* of iPads that results from positive beliefs and perceptions, but did not offer offer any insight into whether instruction had *changed* in any way as a result of the provision of iPads to all secondary teachers.

To explore the concept of "change", we re-examined Puentedura's SAMR Model (2014) for technology integration, one of the theoretical frameworks for this study. These instructional modes for which the iPad is used do represent, to a certain degree, functional improvement in instruction rather than a direct substitution for traditional methods. According to the model, such incorporation of technology, at a minimum, enhances a teacher's instruction. However, the use of the TIM-R in this study specifically looked to quantify the degree to which the use of iPads can transform the *way* in which teaching and learning occur in the classroom, moving away from traditional prescriptive roles of teachers and students towards more substantive ones that support self-directed, collaborative, and project-based learning opportunities. At the highest levels of transformation, the manner in which students participate in higher-order learning activities would not be possible without the integration of the technology. Therefore, to assess the degree to which the lesson is transformed, we investigated further into the data from research question 4

Research questions 2 and 4 examined the four domains of the TUPS (perceived support, perceived preparation, perceptions about technology, and perceived comfort) as well as participants' scores on the TIM-R lesson reflection. The results of research question 2 found statistically significant relationships between perceived support and perceived preparation, perceptions about technology and perceived preparation, perceived preparation and perceived comfort, and between perceptions about technology and perceived level of comfort with technology. These results are not surprising as many of the mechanisms that are in place to support each of these domains likely has a crossover effect on other areas. For example, teachers who feel supported by building and district-level technology staff are more likely to feel comfortable and better prepared to integrate the devices in their classroom instruction. This relationship is mutually dependent, however, as individuals who feel confident and well-prepared to use technology are likely those who have established relationships with support staff and will be most likely to actively seek further assistance and support from these individuals. Furthermore, the relationship between perceptions about technology and the areas of preparation and comfort can also be explained by the fact that those who value the use of technology and the potential benefits for teaching and learning are more likely to be those who frequently integrate the devices in their teaching, thus supporting increased levels of comfort and perceived preparation for further use.

While there may be statistical relationships between these areas of the TUPS, the results of analyses in research question 4 indicated no statistical relationship between these areas of perception and the potential level of transformative technology integration. This result, in itself, *was* significant as it points to the fact that despite a great amount of money and time being spent on providing access to and support for the iPad devices, the devices were not drastically changing the nature of instruction. This fact indicates that despite the multitude of teaching modes for which the devices were being used (research question 1) and the effect that teacher perceptions have on the frequency of iPad use (research question 3), the devices were acting more as a replacement for traditional methods rather than providing impetus for significant redesign and redefinition of learning tasks as indicated on the "transformation" levels of the SAMR model.

The mean scores across the five learning environments of the Technology Integration Matrix ranged from 2.50 to 2.79 with standard deviations ranging from .977 to 1.269. This indicates that the participants, on average achieved TIM-R scores in the adoption and adaptation levels across learning environments. According to the TIM, at the adoption level, the teacher directs students in conventional and procedural use of technology tools. At the adaptation level, the teacher begins to facilitate student exploration of and independent use of technology tools, however there still remains no degree of self-directed learning and the selection of tools remains prescriptive.

Relatively few participants attained scores at the infusion level and even fewer reached transformational levels where the teacher provides the learning context, but students engage in self-directed learning through the use of technology of their choice in a way that promotes higher-order thinking activities that aren't possible without the use of the technology. Transformation was achieved by only 6.4% of participants in the active learning environment, 8.5% in the collaborative environment, 5.3% in the constructive environment, 13.8% in the authentic environment, and 5.3% in the goal-directed environment. In the case of all learning environments, at least 75% of participants' responses results in placement in the entry, adoption, or adaptation level. This statistic further highlights the fact that devices were being used, but not in a way that has any significant effect on the nature of classroom instruction. Furthermore, it is interesting to note that not a single one of the demographic categories (gender, degree attained, subject taught, number of years teaching, and number of students per class) resulted in a significant difference in mean score among participants, thus further highlighting the uniformity of low scores achieved on the TIM-R throughout this study.

Curiously, the average responses in three of the four domains of the TUPS (perceptions about technology, perceived comfort, and perceived support) round to a score of 4 on the Likert scale, representing a response of "agree" with a variety of statements that quantify participants' perceptions in each domain (all of the questions were worded in a way that a higher number represented increased comfort, support etc. and therefore none of the items needed to be inversely coded). The results of this study are consistent with prior research that suggests there may be inconsistencies between teachers' pedagogical beliefs and actual instructional use of technology (Judson, 2006; Levin & Wadmany, 2005). This study, for example, found low level of transformative integration despite seemingly positive perceptions about support received, comfort with technology, and usefulness and benefits of the devices. Consistent with the findings of Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012), even the beliefs of teachers identified as frequent technology users (in the case of their study, the teachers had even received awards for their class technology implementation) were insufficient to incite a pedagogical shift towards more student-centered learning.

How can these inconsistencies be explained? One possible explanation is the fact that the TIM is not primarily about technology, but rather, effective pedagogy. Moving from left to right on the matrix represents more active learning, collaboration, and self-directed learning opportunities that culminate in activities that employ higher-order thinking. In no way does the TIM attempt to quantify how much the devices are used. If this were the case, given the results from research question 1, participants would have likely scored quite high. Rather, the relatively low TIM-R scores may be attributed to too much time being spent learning *how* to prescriptively use the technology rather than focusing on instructional content and allowing students to utilize the technology in any manner that they see fit.

This calls attention to the fact that much of the technology use is based around procedural understanding rather than conceptual understanding. As is the case with iPads, students may be taught how to use a specific app but are for the most part, in lock-step with one another when it comes to employing the technology. Only at the higher levels of the matrix do students maintain this procedural understanding but begin to think critically about which apps, for example, to employ and how. Winkelman (2019) describes this phenomenon, among others, as part of the "Invisible Technology Integration Matrix" and attributes much of the lack of higher-level classification on these invisible factors.

Teacher vs. student ownership of learning is another invisible factor to be considered. At the lowest levels of the TIM, the teacher is sometimes the only one using the technology, often replacing conventional materials such as chalkboards and overhead transparencies with 1:1 devices that are mirrored on a screen (see "delivering instruction" from research question 1). Even at the adoption and adaptation levels, students get their own hands on devices, however, the teacher is still predominantly scripting the lesson and the way in which the devices are used. Students do not get to take ownership over their learning and use of the technology until the highest levels of the TIM. The data in this study indicate that this may be the case; teachers are allowing for technology *use* but are rarely providing opportunity for student-led learning.

Finally, low-level integration scores may be attributed to the question of conventional versus creative use of technology tools. Using the iPads as a digital binder, for notetaking, word processing, or basic photo editing, for example, leaves little room for creativity. Donovan, Hartley & Strudler, (2007) explained that teachers with limited technological knowledge are hesitant to incorporate the technology in a way that modifies existing practice and therefore, more frequently use technology for functions with which they are most comfortable. This "functional fixedness", as Winkelman (2019) calls it, leads to low-level TIM scores whereas providing students with opportunity for creativity and innovation has a more drastic effect on the potentially transformative nature of the devices.

In summary, it is clear that iPads were being used frequently and for a number of instructional purposes. Teacher beliefs about technology and perceptions about their own levels of support, comfort, and preparation *did* positively relate to how often they are using the iPads for instruction. However, the data from the study indicated that this use rarely had much effect on changing the way teachers teach and students learn. Despite relatively high levels of teacher perceptions of comfort, support, and positive ideas about technology that were attained on the Technology Uses and Perceptions Survey, teachers in the sample district, on average, achieved low scores on the Technology Integration Matrix. This points to the possibility that teachers were lacking in areas other than technological comfort and ability. As the TPACK framework indicates, only when teachers possess a high degree of technological, pedagogical, and content knowledge, can they effectively integrate technology in their instruction in a meaningful, and transformative way. Therefore, if a teacher lacks the pedagogical knowledge to effectively design lessons that interweave the technology as a means of facilitating student learning, rather than using the technology as the focus of the lesson, he or she will be unable to attain higher levels of transformative technology integration.

Limitations

A limitation of this study was the small sample size of 94 given the number of independent variables examples. For the purpose of the study, the sample size was limited given the population being specific to teacher volunteers within a single sample district. The statistical strength of a correlation is reduced with a smaller sample size and the effect of outliers are magnified.

The results of this study are limited to the specific population being studied. While this population was specifically selected to gain insight into the practices and perceptions of teachers in a district that employs a 1:1 iPad program, one must exercise caution when generalizing the results of this study to a broader population.

Finally, this study employed an instrument (TIM-R) that measured integration of technology based on teachers' reflection of an individual lesson that demonstrated their highest level of technology. Therefore, the level of potential integration was reflective of what a teacher was able to achieve during single lesson and cannot be generalized to assume this level to be common practice. This study did not employ any measures to determine the frequency with which the teachers achieve this level for potential integration. Furthermore, the self-report aspect of TIM-R data collection may present a challenge to the validity of responses due to the subjective nature of self-reflection. The use of skip-logic questions to determine the level of integration *did* support fidelity of the level of integration, however individual teachers' perceptions of their technology potential may vary thus decreasing the reliability of results.

Implications for Future Research

Future research should continue to explore the relationship between teacher beliefs and perceptions about technology and the integration of devices into instruction. Future researchers may want to replicate this study on a broader scale, including a larger sample size of teachers from a broader range of schools and districts. While this study was limited to teachers utilizing the iPads for instruction, future research may want to investigate the integration of a variety of devices (iPads, Chromebooks, and "Bring Your Own Device" programs) to determine if any significant differences exist in integration among users of these devices.

As another approach to data collection, researchers who utilize the TIM instrument can opt for the TIM-O (Technology Integration Matrix Observation) rather than the TIM-R (Technology Integration Matrix reflection). The TIM-O allows for observers who are trained in the use of the TIM matrix to observe and evaluate teachers' level of transformative integration of technology. Researchers may consider observing the same teachers multiple times to gain greater insight into how technology is regularly integrated rather than using the "snapshot" approach employed in this study. This would also allow the researcher to move away from the need to qualify TIM data as "potential" for integration as multiple data points for a single participant would offer a clearer understanding of consistency of practice rather than examining a single lesson.

Finally, since correlational studies do not provide any information on causation, future research may want to employ a mixed methods design to explore further *why* teachers beliefs affect their integration of technology in classroom instruction. The researcher may conduct follow-up interviews or small focus group discussions to determine the perceived barriers and supports to increased integration of technology.

Implications for Future Practice

The results of this study are useful to both teachers and school leaders because of the insight provided into the daily use of instructional technology in the classroom and the potential teacher perceptions that influence how the devices are integrated. Schools are increasingly investing a great deal of funds into the purchase and management of 1:1 devices. However, as indicated by prior research, the provision of devices is often insufficient to create meaningful change in instruction. Therefore, school leaders in the district from which data were collected can gain insight into the teaching modes for which the iPad program is being utilized, thus providing information for more specific and targeted professional development opportunities to broaden the scope of iPad integration.

This study focused on the relationship between teachers' beliefs and potential for transformative integration of iPads in the classroom. One factor that was examined was the role of teachers perceived level of comfort on technology integration. Kim et al. (2013) indicated that teacher beliefs should be considered when developing technology plans and therefore, this information can be useful to school leaders when developing school and district-level technology plans to include opportunities for teachers to gain added comfort with the use of devices for classroom instruction. For example, opportunities for professional development, professional learning circles, common technology planning time and, inter-classroom visitation may increase teachers' level of comfort. The study also examined the relationship between perceived levels of support and technology integration. This information is critical for district leaders when planning for staffing needs as considerations for increased technology specialists and staff developers can have a positive effect on the success of the 1:1 iPad program.

The use of the TIM-R instrument in this study is important for classroom practitioners to reflect on their own use of technology. Shandomo (2010) indicates that teacher reflection results in "deep understanding of their teaching styles, which enhanced their ability to challenge the traditional mode of practice and define their growth toward greater effectiveness as teachers" (p. 101). This certainly applies to the area of classroom technology as teachers reflect on their own teaching and how technology is implemented in their instruction. If teachers are more mindful of how their own beliefs and perceptions affect technology integration, they may be more willing to challenge their preconceptions and step outside their zone of comfort so as to grow and support their practice.

Finally, the methodologies for data collection in this study through the use of the TIM-tools suite may be of interest to school districts. Aside from the TUPS and TIM-R, the suite also includes the Technology Integration Matrix Lesson Observation Tool (TIM-O), the Action Research for Technology Integration (ARTI), the TIM Coaching Tool (TIM-C), a survey maker, and a lesson planning tool (TIM-LP). The tools are all managed from a central Administration Center from which school districts can easily collect and analyze both qualitative and quantitative data for the purpose of designing well-informed decision-making and alignment of resources at the classroom, school, and district levels.

Summary

In summary, this study examined how iPads are being used for instruction at the secondary level of a suburban school district. The study examined the relationship between teacher perceptions about technology, their perceived level of support, comfort, and preparation and the level of use and potential for transformative integration of the devices for instruction. The results of the study indicated that the iPads are being used frequently and or a variety of instructional purposes. The domains of teacher perceptions were positively correlated to increased use of the iPad, however no significant relationship was found between these perceptions and transformative integration that moves away from traditional instruction to self-directed and student-centered learning activities that involve higher-order thinking. Limitations of the study include a small sample size, a single population, and data based on teacher reflection of a single lesson rather than a broader overview of common practice. Therefore, future research may include a larger sample from a broader population as well as multiple points of data collected on numerous occasions from each participant from an independent observer.

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Appendix A
Institutional Review Board Approval

Federal Wide Assurance: FWA00009066

Oct 22, 2019 1:16 PM EDT

PI: Christopher Pipala
CO-PI: Mary Ellen Freeley
Dept: Ed Admin & Instruc Leadership

Re: Initial - IRB-FY2020-204 ONE-TO-ONE iPAD TECHNOLOGY: PERCEPTIONS VERSUS PRACTICE

Dear Christopher Pipala:

The St John's University Institutional Review Board has rendered the decision below for ONE-TO-ONE iPAD TECHNOLOGY: PERCEPTIONS VERSUS PRACTICE.

Decision: Exempt

Selected Category: Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

Sincerely,

Raymond DiGiuseppe, PhD, ABPP
Chair, Institutional Review Board
Professor of Psychology

Marie Nitopi, Ed.D.
IRB Coordinator

Appendix B
Technology Integration Matrix (TIM)

The Technology Integration Matrix
Table of Summary Descriptors

The Technology Integration Matrix (TIM) provides a framework for describing and targeting the use of technology to enhance learning. The TIM incorporates five interdependent characteristics of meaningful learning environments: active, collaborative, constructive, authentic, and goal-directed. These characteristics are associated with five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. Together, the five characteristics of meaningful learning environments and five levels of technology integration create a matrix of 25 cells, as illustrated below.

LEVELS OF TECHNOLOGY INTEGRATION → / CHARACTERISTICS OF THE LEARNING ENVIRONMENT ↓	ENTRY LEVEL The teacher begins to use technology tools to deliver curriculum content to students.	ADOPTION LEVEL The teacher directs students in the conventional and procedural use of technology tools.	ADAPTATION LEVEL The teacher facilitates the students' exploration and independent use of technology tools.	INFUSION LEVEL The teacher provides the learning context and the students choose the technology tools.	TRANSFORMATION LEVEL The teacher encourages the innovative use of technology tools to facilitate higher-order learning activities that may not be possible without the use of technology.
ACTIVE LEARNING Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.	**Active Entry** Information passively received	**Active Adoption** Conventional, procedural use of tools	**Active Adaptation** Conventional independent use of tools; some student choice and exploration	**Active Infusion** Choice of tools and regular, self-directed use	**Active Transformation** Extensive and unconventional use of tools
COLLABORATIVE LEARNING Students use technology tools to collaborate with others rather than working individually at all times.	**Collaborative Entry** Individual student use of technology tools	**Collaborative Adoption** Collaborative use of tools in conventional ways	**Collaborative Adaptation** Collaborative use of tools; some student choice and exploration	**Collaborative Infusion** Choice of tools and regular use for collaboration	**Collaborative Transformation** Collaboration with peers, outside experts, and others in ways that may not be possible without technology
CONSTRUCTIVE LEARNING Students use technology tools to connect new information to their prior knowledge rather than to passively receive information.	**Constructive Entry** Information delivered to students	**Constructive Adoption** Guided, conventional use for building knowledge	**Constructive Adaptation** Independent use for building knowledge; some student choice and exploration	**Constructive Infusion** Choice and regular use for building knowledge	**Constructive Transformation** Extensive and unconventional use of technology tools to build knowledge
AUTHENTIC LEARNING Students use technology tools to link learning activities to the world beyond the instructional setting rather than working on decontextualized assignments.	**Authentic Entry** Technology use unrelated to the world outside of the instructional setting	**Authentic Adoption** Guided use in activities with some meaningful context	**Authentic Adaptation** Independent use in activities connected to students' lives; some student choice and exploration	**Authentic Infusion** Choice of tools and regular use in meaningful activities	**Authentic Transformation** Innovative use for higher-order learning activities connected to the world beyond the instructional setting
GOAL-DIRECTED LEARNING Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.	**Goal-Directed Entry** Directions given; step-by-step task monitoring	**Goal-Directed Adoption** Conventional and procedural use of tools to plan or monitor	**Goal-Directed Adaptation** Purposeful use of tools to plan and monitor; some student choice and exploration	**Goal-Directed Infusion** Flexible and seamless use of tools to plan and monitor	**Goal-Directed Transformation** Extensive and higher-order use of tools to plan and monitor

Appendix C
Technology Uses and Perceptions Survey (TUPS)

Part 1: Access and Support

	Strongly Disagree	Disagree	Neutral	Agree	Strong Agree
I have adequate access to a technology specialist.					
The technology specialist adequately assists me in solving technical problems with hardware or software.					
The technology specialist is committed to helping teachers find solutions.					
The technology specialist responds promptly to my requests for assistance.					
The technology specialist models techniques to integrate technology into my teaching.					
The technology specialist provides professional development opportunities to teachers and staff.					
The technology specialist adequately assists me in planning and implementing the use of technology in my curriculum, planning, and assessment.					

Part 2: Preparation for Technology Use

	Not at All	To a Small Extent	To a Moderate Extent	To a Great Extent	Entirely
As a part of my undergraduate or graduate coursework.					
In-service courses or workshops (both district-sponsored and otherwise).					
Independent learning (e.g. online tutorials, YouTube videos, books, etc.).					
Interaction with friends and family.					
Interaction with colleagues.					
School / District sponsored professional development (faculty meetings, department meetings, Superintendent's Conference Days).					

Part 3: Perceptions of Technology Use

	Strongly Disagree	Disagree	Neutral	Agree	Strong Agree
I would like every student in my class(es) to use the iPad for classwork and assignments.					
Technology skills are essential to my students' success in school.					
Technology skills are essential to my students' success in their future workplace.					
Daily lessons in my classroom look and sound different as a result of the 1:1 iPad program.					
Using the iPad makes my job easier.					
The 1:1 iPad program positively changes my role as a teacher.					
The 1:1 iPad program allows for the creation of new learning experiences previously inconceivable without technology.					
The 1:1 iPad program enhances my teaching.					
Student use of the iPad enhances student performance.					
My use of the iPad enhances student performance.					
The iPad should be used in all courses.					
I would like my students to be able to use technology more in their courses.					

Part 4: Confidence and Comfort Using Technology

	Strongly Disagree	Disagree	Neutral	Agree	Strong Agree
I have adequate training in the use of the iPad.					
I am comfortable trying out new uses of the iPad for instruction (new apps, websites, activities, etc.).					
I feel prepared to integrate the iPad into my daily teaching.					
I feel prepared to use the iPad to go paperless in my teaching.					
I am prepared to guide other teachers in planning and implementing lessons that use the iPad.					
I am comfortable with students using the iPad for independent learning opportunities in the classroom.					
I am comfortable assigning projects to be completed on the iPad.					
I am comfortable allowing students to utilize the iPad to learn independently at home.					
I am developing expertise in the uses of the iPad in teaching.					
I am comfortable designing iPad-based assessments.					
I am comfortable teaching my students about the responsible use of technology.					

Part 5: Technology Integration

	Not At All	Once per Month or Less	Once per Week	Several Times per Week	Every Day	Multiple Times per Day
Small Group instruction						
Individualized instruction						
As a means of facilitating collaborative / cooperative learning.						
Independent learning (in school or at home)						
For flipped learning						
As a reward						
To tutor / For remediation						
As a research tool for my students						
As a tool for students to use in planning and managing projects (individual and group)						
As a productivity tool to manage workflow (taking notes, completing assignments, grading student work, etc.)						
As a student-delivered presentational tool (including multimedia)						
As a means of delivering instruction (e.g. iPad mirroring)						
As a communication tool (e.g. email, Google Classroom, electronic discussion, etc.)						
To create new instructional content for my students						
As a means of assessing learning						

Appendix D
Participant Survey Instrument Instructions

Research Study Instructions

Thank you for your willingness to participate in this research study. This study will examine how iPads are being used for instruction at the secondary level of a suburban school district as well as the relationship between teacher ideas and perceptions about technology and perceived level of technology integration.

Please carefully read the following instructions that will guide you through the use of the TIM survey instrument!

The URL for the survey instrument is found in Step 1 on page 3!

There are TWO parts to this study:

1. Lesson Reflection → Answer questions about a particular lesson in which you feel you utilized the iPad in a way that, to the greatest degree, *transformed* your instruction.

2. Technology Uses and Perceptions Survey → Answer a series of questions about your perceptions and beliefs about instructional technology.

* It is essential that you complete *BOTH* parts of the study *

Step 1: Access both survey tools at cp.tim-tools.com. You will see the following welcome screen. Please carefully read the posted information about the study:

Welcome

Welcome to the TIM Tools research page. Thank you very much for your willingness to participate in this research. This study aims to examine the relationship between various teacher perceptions about instructional technology (particularly the 1:1 iPad program) and the level of technology integration in classroom instruction.

In order to participate, you must complete **two** items, both accessible via the left-hand navigation bar. It is imperative that you complete *both* parts of study:

TUPS - Technology Use and Perceptions Survey

The TUPS collects information about what teachers believe about the role of technology in the classroom, as well as their access to technological support, comfort and confidence with technology, and personal preparation for technology use.

TIM-R - Technology Integration Matrix Reflection

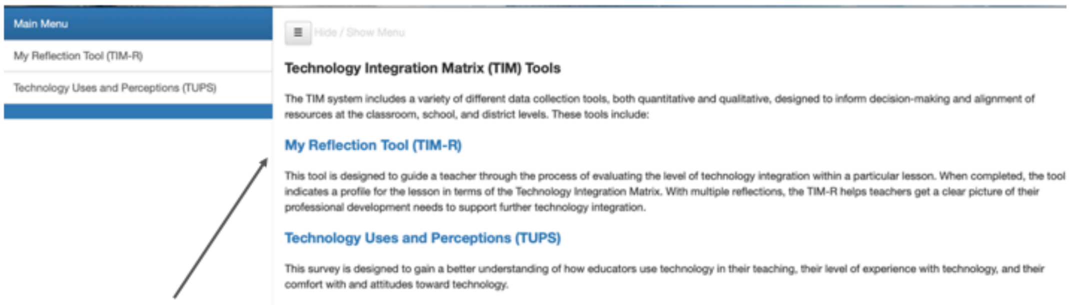
The TIM-R is designed to guide a teacher through the process of reflective evaluation of the level of technology integration within a particular lesson. When accessing the TIM-R, you will be asked to select either a "Question-Based" or "Matrix-Based" reflection. Please selection *Question-Based*. Answer the questions that follow based on a reflection of a previous lesson that you feel demonstrates your highest level of *potential* for technology integration.

All answers will remain anonymous and no identifiable information about participants will be shared.

Should you have any questions, please contact Chris Pipala via email: christopher.pipala17@my.stjohns.edu

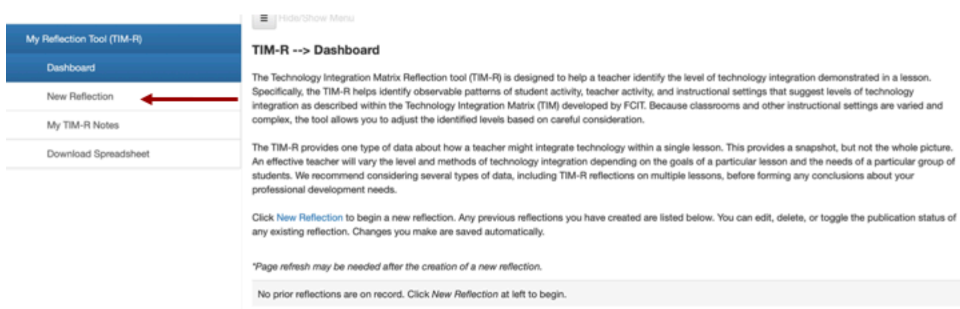
Again, **THANK YOU** for your time!

Step 2: Enter your assigned username / password and click "Sign In". You will see the following Main Menu page:



Step 3: Click "My Reflection Tool (TIM-R)".

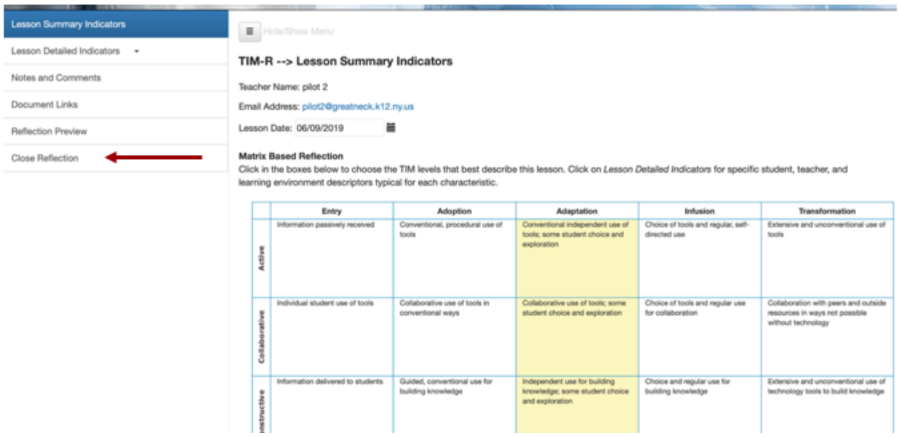
Step 4: Click "New Reflection" to begin your lesson reflection.



Step 5: Select "Question-based" reflection and click "Begin a Reflection"

Step 6: Answer all questions that follow. As indicated on the welcome page instructions, please reflect on a single lesson that you feel demonstrated your maximum *potential* for transformative technology integration.

Step 7: When finished with the questions, a technology integration matrix will be completed based on your answers. Click "Close Reflection" to continue.



Step 8: Click "Not Published" to finalize your reflection. The button text will change to "Published"

TIM-R --> Dashboard

The Technology Integration Matrix Reflection tool (TIM-R) is designed to help a teacher identify the level of technology integration demonstrated in a lesson. Specifically, the TIM-R helps identify observable patterns of student activity, teacher activity, and instructional settings that suggest levels of technology integration as described within the Technology Integration Matrix (TIM) developed by FCIT. Because classrooms and other instructional settings are varied and complex, the tool allows you to adjust the identified levels based on careful consideration.

The TIM-R provides one type of data about how a teacher might integrate technology within a single lesson. This provides a snapshot, but not the whole picture. An effective teacher will vary the level and methods of technology integration depending on the goals of a particular lesson and the needs of a particular group of students. We recommend considering several types of data, including TIM-R reflections on multiple lessons, before forming any conclusions about your professional development needs.

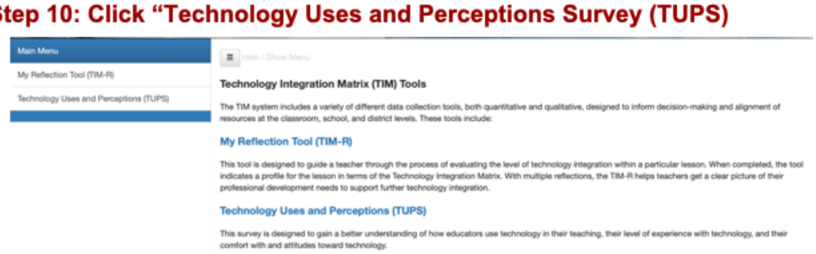
Click New Reflection to begin a new reflection. Any previous reflections you have created are listed below. You can edit, delete, or toggle the publication status of any existing reflection. Changes you make are saved automatically.

**Page refresh may be needed after the creation of a new reflection.*

Teacher	Date	Action		
pilot 2	06/09/2019	Edit	Delete	Not Published

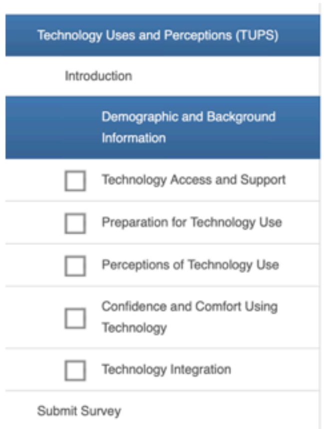
Step 9: Click "Main Menu" in upper left corner to continue.

Step 10: Click "Technology Uses and Perceptions Survey (TUPS)



Step 11: Click "New Survey"

Step 11: Complete *all* sections of the survey (as indicated on the left-side) navigation bar



After answering all questions in a given section, click "Next" to advance to the next section.

At any time, you can leave the survey and come back without losing your responses by clicking "Save and Return Later"

Step 12: Ensure that all sections are marked as "Complete". Then click "Submit Survey".

Survey will not submit until all sections listed below are complete. Once survey is submitted, it cannot be edited.

Submit Survey

Status

Section	Status
Demographic and Background Information	Complete
Technology Access and Support	Incomplete
Preparation for Technology Use	Incomplete
Perceptions of Technology Use	Incomplete
Confidence and Comfort Using Technology	Incomplete
Technology Integration	Incomplete

Done!

Thank you for your participation in this study!

Appendix E
Superintendent Permission Letter

Dear Dr. [redacted],

I am a doctoral student at St. John's University and am writing to request permission to collect and analyze data from teacher participants in your school district as part of my dissertation research. My research, entitled "One-to-One iPad Technology: Perceptions Versus Practice" will investigate how iPads are being used for instruction at the secondary level of the district and examine the relationship between various teacher perceptions about technology and the potential level of transformative integration of the devices in secondary classrooms.

If you agree to allow your district to participate in this study, by replying to this email with your consent, principals of the five secondary schools will be contacted to solicit participation from teachers who self-identify as iPad users. Teacher volunteers will be provided a unique username to access the *Technology Uses and Perceptions Survey* and the *Technology Integration Matrix* tools from the Florida Center for Instructional Technology. Demographic information about subjects taught, number of years teaching, and number of years teaching with iPads will be collected, however, the usernames will contain no identifiable information and therefore participants will remain anonymous during data analysis. Participation in the study is voluntary and should take no longer than 15 minutes. Individual responses to the survey will remain confidential.

If you have any questions regarding the study please feel free to contact me. My telephone number is 631-219-3279, and my email address is christopher.pipala17@stjohns.edu. Dr. Mary Ellen Freeley, my dissertation supervisor, may also be contacted at freeleym@stjohns.edu or at St. John's University at 718-990-5537. If you have any questions about rights as a research subject, you may contact the St. John's University Institutional Review Board by telephone at (718) 990-1440, or by email at irbstjohns@stjohns.edu.

Following completion of this research project, I would be pleased to share the findings with you. Please email me to request the findings. Thank you in advance for your assistance.

Sincerely,
Chris Pipala

Appendix F
Principal Permission Letter

ST. JOHN'S UNIVERSITY

Dear Principal,

I am a doctoral student at St. John's University and am writing to request permission to collect and analyze data from teacher participants in your school as part of my dissertation research. My research, entitled "One-to-One iPad Technology: Perceptions Versus Practice" will investigate how iPads are being used for instruction at the secondary level of the district and examine the relationship between various teacher perceptions about technology and the potential level of transformative integration of the devices in secondary classrooms.

If you agree to allow your teachers to participate in this study, by replying to this email with your consent, teachers will be contacted to solicit volunteers who self-identify as iPad users. These teachers will be provided a unique username to access the *Technology Uses and Perceptions Survey* and the *Technology Integration Matrix* tools from the Florida Center for Instructional Technology. Demographic information about subjects taught, number of years teaching, and number of years teaching with iPads will be collected, however, the usernames will contain no identifiable information and therefore participants will remain anonymous during data analysis. Participation in the study is voluntary and should take no longer than 15 minutes. Individual responses to the survey will remain confidential.

If you have any questions regarding the study please feel free to contact me. My telephone number is 631-219-3279, and my email address is christopher.pipala17@stjohns.edu. Dr. Mary Ellen Freeley, my dissertation supervisor, may also be contacted at freeleym@stjohns.edu or at St. John's University at 718-990-5537. If you have any questions about rights as a research subject, you may contact the St. John's University Institutional Review Board by telephone at (718) 990-1440, or by email at irbstjohns@stjohns.edu.

Following completion of this research project, I would be pleased to share the findings with you. Please email me to request the findings. Thank you in advance for your assistance.

Sincerely,
Chris Pipala

Appendix G
Teacher Participation Letter

Dear Teacher,

I am a doctoral student at St. John's University and am writing to request your participation in my dissertation research. My research, entitled "One-to-One iPad Technology: Perceptions Versus Practice" will investigate how iPads are being used for instruction at the secondary level of the district and examine the relationship between various teacher perceptions about technology and the potential level of transformative integration of the devices in secondary classrooms.

The only criterion for participation is that you and your students utilize the one-to-one iPad program as part of your instruction. No minimum level of iPad skill or competency is required to participate in this study. As a volunteer, you will be provided a unique username to access the *Technology Uses and Perceptions Survey* and the *Technology Integration Matrix* tools from the Florida Center for Instructional Technology. Demographic information about subjects taught, number of years teaching, and number of years teaching with iPads will be collected, however, the usernames will contain no identifiable information and therefore participants will remain anonymous during data analysis. Participation in the study is voluntary and should take no longer than 15 minutes. Individual responses to the survey will remain confidential.

If you have any questions regarding the study please feel free to contact me. My school telephone number is 516-441-4648, and my email address is christopher.pipala17@stjohns.edu. Dr. Mary Ellen Freeley, my dissertation supervisor, may also be contacted at freeleym@stjohns.edu or at St. John's University at 718-990-5537. If you have any questions about rights as a research subject, you may contact the St. John's University Institutional Review Board by telephone at (718) 990-1440, or by email at irbstjohns@stjohns.edu.

Following completion of this research project, I would be pleased to share the findings with you. Please email me to request the findings. I want to thank you in advance for your help and timely response to this survey. Your participation is important to the overall success of this project.

Sincerely,
Chris Pipala

Appendix H
District-Level Approval Email

Christopher Pipala
Thu 10/24/2019 3:11 PM
[redacted]

Superintendent Permission Le...
83 KB

[redacted]

I am writing to formally request permission to conduct a doctoral dissertation research study in your district. Please see attached letter for more details. A reply to this email will suffice.

Thank you for your time and consideration. If you have any questions, please do not hesitate to reach out.

Sincerely,

Christopher Pipala
Doctoral Student - St. John's University
631-219-3279
christopher.pipala17@my.stjohns.edu

[redacted]
Fri 12/13/2019 8:17 AM
Christopher Pipala; [redacted]

* External Email *

Given that teacher participation is purely voluntary (and be careful to make that clear to those you directly supervise), your doctoral research is approved. In fact, as "action research", the findings will certainly be of interest to the District, and to [redacted] in particular.

A couple of observations:

1. Your first research question has two parts—did anyone suggest separating them? Should you consider doing so?
2. No connection is hypothesized between technology use and student outcomes. This would certainly be a valuable "further study" area, as would a similar study in intermediate grades 3-5.
3. I suggest naming "[redacted]" by another name. You've used care not to specifically identify the district or the other secondary locations, so it would make sense to preserve this anonymity (to the extent possible) as well.

Best of luck in your studies, and please share the results when completed.

[redacted]

[redacted]
Assistant Superintendent for Secondary Education
[redacted]

Appendix I
Building-Level Approval Emails

CP

Christopher Pipala
Fri 12/13/2019 8:34 AM
[redacted]

Dear [redacted]

I am writing to request permission to collect data for my dissertation research at your school. A formal permission request letter with more details about my study can be accessed by clicking the link below.

If you approve, kindly reply to this email. If you have any questions, please do not hesitate to reach out.

https://docs.google.com/document/d/1lu22S4zOgX018FrK32LKGOfMjybV7_NxAlnoDwl2AV8/edit?usp=sharing

Regards,

Christopher Pipala
Doctoral Student - St. John's University
631-219-3279
christopher.pipala17@my.stjohns.edu

HD

[redacted]
Fri 12/13/2019 1:04 PM
Christopher Pipala

* External Email *

OK with me.

[redacted]
Principal
[redacted]
"The whole is greater than the sum of its parts." --- Aristotle

Christopher Pipala
Fri 12/13/2019 8:36 AM
[redacted]

Dear [redacted]

I am writing to request permission to collect data for my dissertation research at your school. A formal permission request letter with more details about my study can be accessed by clicking the link below.

If you approve, kindly reply to this email. If you have any questions, please do not hesitate to reach out.

https://docs.google.com/document/d/1lu22S4zOgX018FrK32LKGOfMjybV7_NxAlnoDwl2AV8/edit?usp=sharing

Principal Permission Letter

Dear Principal, \u000BI am a doctoral student at St. John's University and am writing to request permission to collect and analyze data from teacher participants in your school as part of my dissertation research. My research, entitled "One-to-One iPad Technology: Perceptions Versus Practice" will...

docs.google.com

Regards,

Christopher Pipala
Doctoral Student - St. John's University
631-219-3279

[redacted]
Fri 12/13/2019 2:58 PM
Christopher Pipala

* External Email *

Hi Chris,

This works for me! Good luck during your research.

Have a great weekend!

[redacted]
Principal
[redacted]

Christopher Pipala
Fri 12/13/2019 8:35 AM
[redacted]

Dear [redacted]

I am writing to request permission to collect data for my dissertation research at your school. A formal permission request letter with more details about my study can be accessed by clicking the link below.

If you approve, kindly reply to this email. If you have any questions, please do not hesitate to reach out.

https://docs.google.com/document/d/1lu22S4zOgX018FrK32LKGOfMjybV7_NxAlnoDwl2AV8/edit?usp=sharing

Regards,

Christopher Pipala
Doctoral Student - St. John's University
631-219-3279
christopher.pipala17@my.stjohns.edu

Request for Permission - Dissertation Research

[redacted]
Fri 12/13/2019 8:59 AM
Christopher Pipala

* External Email *

Mr. Pipala - This sounds great. Best of luck with your study. Approval granted.

[redacted]

[redacted]
Principal
[redacted]

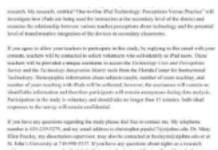
Christopher Pipala
Fri 12/13/2019 8:37 AM
[redacted]

Dear [redacted]

I am writing to request permission to collect data for my dissertation research at your school. A formal permission request letter with more details about my study can be accessed by clicking the link below.

If you approve, kindly reply to this email. If you have any questions, please do not hesitate to reach out.

https://docs.google.com/document/d/1lu22S4zOgX018FrK32LKGOfMjybV7_NxAlnoDwl2AV8/edit?usp=sharing



Principal Permission Letter

Dear Principal, \u000BI am a doctoral student at St. John's University and am writing to request permission to collect and analyze data from teacher participants in your school as part of my dissertation research. My research, entitled "One-to-One iPad Technology: Perceptions Versus Practice" will...

docs.google.com

Regards,

Christopher Pipala
Doctoral Student - St. John's University
631-219-3279
christopher.pipala17@my.stjohns.edu

[redacted]
Fri 12/13/2019 11:47 AM
Christopher Pipala

* External Email *
Okay, sure. Sounds like a very interesting study.

...

Thanks! | I thought so too. | I agree!

Are the suggestions above helpful? Yes No

Vita

Name	*Christopher Pipala*
Baccalaureate Degree	*Bachelor of Arts, College of the Holy Cross, Worcester, MA Major: Spanish, Economics*
Date Graduated	*May 2009*
Other Degrees and Certificates	*Masters of Arts, Boston University Boston, MA. Major: Teaching Spanish*
Date Graduated	*May 2011*
	Advanced Certificate, Educational Leadership, LIU Post, Brookville NY Major: Educational Leadership
Date Graduated	*May 2016*