HOW DEEPER LEARNING AND 21ST CENTURY SKILLS INFLUENCED ONE SUBURBAN DISTRICT’S TRANSITION TO 1:1 STUDENT TECHNOLOGY

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Paula A. Dillon

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Dr. Chris Unger
Advisor

College of Professional Studies
Northeastern University
Boston, Massachusetts

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Abstract

The purpose of this study was to examine administrator, student, and teacher perceptions of organizational structures, systems, and supports implemented to aid technology integration, and the potential for that technology integration to achieve 21st century skill acquisition and deeper learning in a 1:1 environment. The Diffusion of Innovation Theoretical Framework guided the design and analysis of this study. Further, a literature review of the integration of technology into content and pedagogy informed this study. The overarching research question for this study asked how teachers, students, and administrators perceive the implementation of a 1:1 district-wide implementation initiative, and its impact on 21st century skill acquisition and deeper learning. As such, the study sought to answer the following questions: (1) How has the district organized itself to support technology integration by teachers with the specific intent of fostering deeper learning and 21st century skills? and (2) How do administrators, teachers, and students perceive the implementation of 1:1 and its impact on 21st century skills and deeper learning? An instrumental case study approach was used to explore and describe the perceptions of administrators, students and teachers using rich-description of their experiences. It is evident that the purposeful integration of technology in the 1:1 environment led to student acquisition of 21st century skills and deeper learning at the study site. In addition, the study revealed structures and supports necessary to facilitate 1:1 programs to foster deeper learning and 21st century skills including strong communication, robust infrastructure, long-range planning, stakeholder engagement, professional learning, collaboration and time. The findings of this study, along with the identification and analysis of related themes, have the potential to inform similar districts as they embark on the implementation of 1:1 programs to foster 21st century skills and deeper learning competencies.

Keywords: 1:1, technology integration, deeper learning, 21st century skills, innovation
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Chapter I: Introduction

The Topic

Since the advent of the ballpoint pen, educators have been using technology in their classrooms to some degree daily. The clear majority of technology use in classrooms today focuses primarily on presentation software, word processing software, Internet searches, basic skills practice, spreadsheets, educational Web sites, and management tools (Harris, Mishra, & Koehler, 2009; Penuel, 2006). As different types of technologies have become available, accessible, and relatively affordable, educators are shifting their attention from the use of technology in teaching and learning to the purposeful integration of that technology. Unlike technology use, purposeful technology integration requires teachers to integrate their knowledge of content and pedagogy with technologies that support and expand their students’ learning in ways previously inconceivable (Harris, Mishra, & Koehler, 2009; Mishra & Koehler, 2006; Mishra, Koehler, & Henriksen, 2011). For instance, in a classroom where technology is purposefully integrated, teachers might provide students with opportunities to research a real-world problem, develop a solution, use a multi-media presentation to demonstrate their findings, and present a call to action to an authentic audience.

According to Dr. Ruben Puentedura’s (2014) SAMR Model (Substitution, Augmentation, Modification, Redefinition), the purposeful integration of technology moves from the use of technology as a substitute or augmentation tool, to the ability to modify and redefine teaching and learning. For example, in a classroom where teachers use technology as a substitution, students may take notes on a computer instead of paper and pencil (Puentedura, 2014). Whereas, in a classroom where teachers purposefully integrate technology to transform teaching and learning, students may travel around the globe, interacting and communicating with native inhabitants, creating and sharing their learning globally, without leaving their classroom (Puentedura, 2014).
As illustrated in these examples, there is a significant difference between technology use and purposeful technology integration.

In detailing learning opportunities, such as those noted above, many educators and researchers contend that technology has the power and potential to revolutionize education (Friday Institute, 2011; Jacobs, 2010; OECD, 2015a; Project Tomorrow, 2015; Topper & Lancaster, 2013). The United State Department of Education’s (U.S. D.O.E.) National Educational Technology Plan (2010) has laid the foundation for the future of education where technology integration is the norm. The plan issues a challenge to school districts across the country to provide students with “always on” access to technology for individualizing and personalizing instruction while increasing access to high-quality resources (U.S. D.O.E., 2010). Since the release of the plan, schools have begun the formidable transition to learning environments where every student has access to a mobile or digital device (1:1). To understand this growing trend, Project Tomorrow (2015) has released the findings of a national survey, including the results from over 430,000 students, 8,000 schools, and 2,600 school districts. The survey results indicate that 24/7 access to school-issued technology has the potential to deepen student thinking, increase student-centered teaching practices, support the acquisition of 21st century skills, and empower students as self-directed learners. However, the study also reveals that “As with most things in education, getting from vision to actualization is often a difficult and circuitous route” (Project Tomorrow, 2015, p. 1). Thus, without an understanding of the structures and supports that teachers, students, and administrators perceive as useful in supporting a transition to 1:1 teaching and learning, 1:1 initiatives will fail to meet important objectives, such as fostering deeper learning and the acquisition of 21st century skills.
Problem of Practice

Understanding the research surrounding technology access and integration is critical, as public schools across the country are quickly moving to learning environments that afford students with 1:1 access to technology. In fact, student use of Internet-accessible devices is the burgeoning norm in public schools. The most recent data from the National Center for Education Statistics (U.S. D.O.E., 2012) indicates that the ratio of student to Internet-ready devices is 1:3 (one device per three students), and increasing. However, there is growing concern regarding the readiness of teachers and the ability of these 1:1 initiatives to influence teaching and learning in positive and meaningful ways (Friday Institute, 2011; Groff; 2013; OECD, 2015a; Topper & Lancaster, 2013). Many districts thrust 1:1 initiatives upon teachers with very little planning or insufficient, poorly designed professional learning opportunities (Topper & Lancaster, 2013). In fact, a significant number of 1:1 rollouts lack a clear vision, and fail to include teachers and students as stakeholders throughout the adoption and implementation process (Holcomb, 2009; Topper & Lancaster, 2013; Project Tomorrow, 2015). To date, relatively few studies have focused on the organizational structures, practices, and use of resources to support purposeful technology integration by teachers. Little research exists describing the experiences of teachers regarding the supports and structures that benefit their ability to integrate technology effectively to achieve these potential benefits.

Studies from the OECD (2015a) suggest that the investment in 1:1 solutions is not advantageous to teaching and learning when districts and schools do not establish a clear purpose. Since 1:1 without identified objectives is an ineffective strategy for enhancing teaching and learning (Holcomb, 2009; OECD, 2015a), it is critical that educators understand the knowledge and skills that students need for college and career in defining the goals of 1:1. Studies point to the need for students to achieve deeper learning competencies and 21st century skills, including
communication, creativity, collaboration, critical thinking, content knowledge, academic mindset, global citizenship, and perseverance (American Institutes for Research; 2014; Fullan & Langworthy, 2014; Koenig, 2011; OECD, 2013; P21, 2011; William & Flora Hewlett Foundation, 2013). Moreover, evidence from the labor market is clear, “Non-routine problem-solving and complex communication skills are becoming increasingly valuable” (Koenig, p. 1, 2011). In fact, research suggests that an increasing number of jobs and careers rely on the individual’s ability to use technology as connected to 21st century skills, where judgment and critical thinking are crucial (Koenig, 2011).

Additional studies, such as the American Institutes for Research (AIR) Deeper Learning Opportunities and Outcomes study and the Linked Learning Initiative in California, reveal that student engagement and success increase when teachers challenge students with real-world problem solving (AIR, 2014; Guha, Caspary, Stites, Padilla, Arshan, Park, Tse, Astudillo, Black, & Adelman, 2014). Through such challenges, research suggests that students are more likely to collaborate, communicate effectively, use evidence-based judgment, persevere in problem-solving, and exhibit strong organizational and self-management strategies (AIR, 2014; Guha et al., 2014). Furthermore, research points to increased student engagement, feedback, personalization, collaboration, communication, critical thinking, and creativity in technology-rich classrooms (Bonk, 2010; Dunleavy, Dextert, & Heinecket, 2007; Fullan & Langworthy, 2014; Gulek & Demirtas, 2005; Muir, Knezek, & Christensen, 2004; Rose & Beck-Hill, 2012; Saavedra, Opfer, 2012), as well as decreased absenteeism (Lemke & Martine, 2003; Texas Center for Educational Research, 2008).

Research from studies such as those conducted by OECD (2015a) and the Friday Institute (2011) point to these deeper learning and 21st century skills as the fundamental factors supporting
the integration of technology. They note that findings suggest technology integration has greater potential to enhance metacognitive, intrapersonal, and interpersonal skills than to increase academic outcomes on standardized assessments (Friday Institute, 2011; OECD, 2015a). However, without appropriate planning, structures and supports, many educators are unable to integrate technology effectively to support the goals of student 21st century skill acquisition and deeper learning (Argueta, Huff, Tingen, & Corn, 2011; Holcomb, 2009; Topper & Lancaster, 2013). In connecting the purpose of 1:1 with these overarching goals, schools can develop strategies, structures, and supports for the successful implementation of 1:1 solutions. Importantly, linking the integration of technology to these goals is significant because, “Technology allows students to transfer skills to different contexts, reflect on their thinking and that of their peers, practice addressing their misunderstandings, and collaborate with peers” (Saavdera & Opfer, 2012, p. 9). Moreover, the ability to transfer knowledge and skills results in deeper learning (Huberman, Bitter, Anthony, & O’Day, 2014; Fullan & Langworthy, 2014; National Research Council, 2012).

However, even when districts set clear goals and objectives, there is a lack of research examining administrator, teacher and student perceptions of the utility of technology integration to foster and support deeper learning and 21st century skill acquisition (Topper & Lancaster, 2013). Numerous studies indicate that student access to Internet-ready devices alone is not sufficient to guarantee changes in teaching practices or student acquisition of 21st century skills (Argueta et al., 2011, Project Tomorrow, 2015; OECD, 2015a). Thus, it is critical to understand and study the factors that lead to the transformation of teaching and learning in technology-rich environments (Mishra, Koehler & Henricksen, 2011).
Study Site

The site for this study provides an opportunity to examine a 1:1 initiative aimed at achieving deeper learning and 21st century skill acquisition. The district, referred to as Greendale Public Schools for this study, implemented a 1:1 Chromebook computing environment for students in grades nine through twelve beginning fall 2015. They expanded this initial rollout to include grades six through eight in the fall of 2016, and will add grades four and five in the fall of 2017. To accomplish a phased-rollout, the district developed a strategic, long-range plan intended to enhance teaching and learning through the 1:1 solution. As such, Greendale provided students with 1:1 devices to support the integration of technology in teaching and learning, to improve student 21st century skill acquisition, and to foster deeper learning. Thus, the purpose of this study was to examine administrator, student, and teacher perceptions of organizational structures, systems and supports implemented to aid technology integration, and the potential for that technology integration to achieve 21st century skill acquisition and deeper learning in a 1:1 environment.

Statement of Significance

Because the world is increasingly interconnected, the skills that students require for college and career have drastically changed (Koenig, 2011; OECD, 2013). Teachers must learn how to prepare students with the necessary skills for success in the 21st century, including collaboration, communication, critical thinking, creativity, citizenship, and global awareness (Koenig, 2011; NRC, 2012; OECD, 2015a; Partnerships for 21st Century Skills, 2009; U. S. D.O.E Office of Educational Technology, 2010). The development of these skills requires a shift in pedagogical strategies (Fullan & Langworthy, 2014; Groff, 2013; Jacobs, 2010; National Research Council, 2012; Stošić, & Stošić, 2013). Saavedra and Opfer (2012) outline the pedagogical shifts necessary in 21st century classrooms. They offer nine practical instructional strategies to support this transition: “Make it
relevant; Teach through the disciplines; Develop thinking skills; Encourage learning transfer; Teach students how to learn; Address misunderstandings directly; Treat teamwork like an outcome; Exploit technology to support learning; and Foster creativity” (Saavedra & Opfer, 2012, p. 11).

Like Saavedra and Opfer (2012), the National Research Council (NRC, 2012), Huberman et al. (2014), and Fullan and Langworthy (2014) offer pedagogical suggestions to support deeper learning. Per the research, one of the most critical factors in fostering deeper learning is challenging students with rich and complex tasks (Fullan and Langworthy, 2014; NRC, 2012). These rich tasks allow students to examine real-world problems across disciplines, increasing their ability to transfer knowledge and skills across situations (Fullan and Langworthy, 2014; Huberman et al., 2014; NRC, 2012). To lay the foundation that supports student success with such tasks, studies from the NRC (2012) point of specific instructional strategies.

First, the NRC (2012) recommends that teachers provide students with a variety of visual representations, such as charts and graphs, and simulations to support the development and transfer of knowledge across tasks and settings. In addition, the NRC (2012) suggests that teachers encourage students to ask probing questions and provide details and rich, descriptive explanation during such activities as determining the author’s purpose or meaning. Moreover, the NRC (2012) emphasizes the importance of using models and exemplars in classroom instruction. They explain that modeling should demonstrate higher order thinking skills for students. Additionally, the NRC (2012) urges teachers to help students make connections from their learning to their background and experiences as a method of motivation. Finally, the NRC (2012) stresses the importance of formative assessment in making learning visible, providing monitoring and feedback, and engaging in peer and self-assessment.
The NRC (2012) recommends that teachers use cross-disciplinary, inquiry-based instructional strategies in collaborative learning environments to promote the transfer of knowledge and skills across situations. For example, NRC (2012) draws upon research demonstrating increased student achievement in cross-disciplinary, inquiry-based fifth-grade classrooms. In these interdisciplinary classrooms, teachers presented teams of students with problems that crossed academic disciplines. Students worked as teams to find and communicate solutions, outperforming their peers in traditional science classrooms (NRC, 2012). The findings of the NRC (2012) suggest that in these inquiry-based classrooms, students developed intrapersonal skills of communication and collaboration, the intrapersonal skills of learning to learning positive academic mindsets, and the cognitive skills required to master content, critically think, and problem solve. Thus, research findings support the importance of the previously described pedagogies in reaching deeper learning and achieving 21st century skills (Fullan and Langworthy, 2014; Huberman et al., 2014; NRC, 2012).

Intended Audiences

Although studies do not cite technology integration as critical to deeper learning and 21st century skill acquisition (Huberman et al., 2014), many school districts are transitioning to 1:1 learning environments to meet these challenges (Argueta et al., 2011; Topper & Lancaster, 2013). Yet, the purpose and outcome of the adoption of 1:1 devices in many of these districts are unclear, and at times, counterproductive (Friday Institute, 2011; Groff, 2013; OECD, 2015a). As Groff (2013) stresses, the shift to 1:1 creates unique instructional hurdles, making it necessary to understand the essential strategies to support all involved stakeholders. In fact, teachers can further enhance the pedagogical strategies outlined above to achieve deeper learning and 21st century skills through the purposeful integration of technology (Mishra & Koehler, 2006; Harris, Mishra &
Koehler, 2009; Mishra et al., 2011). As such, in examining this study, teachers and educational leaders will have insight into relevant findings to consider in implementing their own purpose-driven 1:1 solutions.

The findings arrived at through this study also have the potential to support district and school policy and practice in their decisions around 1:1 solutions. Because many districts are currently implementing 1:1 solutions without the benefit of strategic plans steeped in research, little changes are occurring in teaching and learning (Groff, 2013; OECD, 2015a). Further, research captures minimal consideration of administrator, teacher and student perspective in the study of 1:1 decisions and resulting outcomes related to 21st century skills (Topper & Lancaster, 2013).

Garnering the perspective of administrators, teachers, and students regarding the structures and supports necessary for 1:1 teaching and learning, as well as their perspective on the potential impact of technology integration on 21st century skill acquisition and deeper learning, can help districts develop meaningful strategic implementation plans to reach these ends (Topper & Lancaster, 2013).

It is critical that any technology plan addresses the goals and objectives of teaching and learning. As such, it is important that there is a culture of trust and collaboration between teachers and administrators, where modeling and communication are the norm (Holcomb, 2009). To that end, it is essential to understand the needs and perceptions of the teachers involved in the implementation of 1:1. It is also critical to evaluate teacher understanding of the message, create opportunities for their leadership in shaping the program, and address their perceptions regarding the strengths and weaknesses of the implementation.

Even when districts include teachers in the planning and implementation of 1:1 solutions, with clear objectives, they often forget the voice of students. The limited research available about student perceptions typically focuses on the college level (Changchit, Cutshall, & Elwood, 2006).
Yet, research suggests systems that include students as viable members of planning and implementing have a greater chance of understanding students’ needs and perceptions regarding the transition (Changchit et al., 2006; Håkansson Lindqvist, 2015). Students offer valuable perspectives regarding teaching and learning, which can bolster the success of 1:1 in fostering deeper learning and supporting the acquisition of 21st century skills (Changchit et al., 2006; Håkansson Lindqvist, 2015).

In using a qualitative case study approach, this study captured the administrator, student, and teacher perspective on structures and supports necessary for 1:1 solutions, as well as the potential for technology integration to lead to deeper learning and the acquisition of 21st century skills. Thus, this study has the potential to provide educators and leaders with insight to the critical structures and strategies that districts can employ as they implement 1:1 to reach their specific ends, in this case, deeper learning and 21st century skill acquisition.

**Positionality Statement**

As indicated by Machi and McEvoy (2012), it is natural that researchers have personal interests and biases about the topics they select. I am not an exception to the rule. The interest in technology integration stems from my experiences as a student, teacher, and leader. I have championed the purposeful integration of technology, 21st century skills, and deeper learning within my school community, and the larger educational community. Additionally, I believe in the power of communication, collaboration, human capital, and time to drive and sustain improvements. Thus, I recognize that I must own these biases, and control for them in research (Machi & McEvoy, 2012). Hence, as leader in the district included in this study, I engaged in continuous self-reflection to analyze the biases indicated above.
Challenges as a researcher related to my positionality. Because I lead the work of curriculum, instruction, assessment and professional development in my organization, it was impossible for me to remove myself from the institution to conduct my research study. As indicated by Maxwell (2005, p. 109), I developed an understanding of my influence on the research study, and “use[d] it productively.” As I have been an active participant in my organization, I do not believe that my role in the focus group interviews that I conducted yielded undue influence that will taint the validity of research (Maxwell, 2005).

As we continue our journey to 1:1, I recognize that as a district leader, I entered the role of research from a position of privilege and power (Briscoe, 2010). Since I have been a member of the organization for some years, and since I am not a direct evaluator of the participants intended for this study, I believe that I earned the level of trust necessary for teachers, administrators and students to speak openly (Briscoe, 2010).

Positionality in context. Because I am unable to eliminate my biases (Maxwell, 2005) concerning the importance of technology integration into pedagogy and content, it was important that I reflected on my background to frame that bias. I did not allow my bias to color the findings of my research, but realized that it was important that I acknowledge my positionality in the context of this study. As Maxwell notes, “Separating your research from other aspects of your life cuts you off from a major source of insights, hypotheses, and validity checks” (2005, p. 38). Thus, to understand my interest and the significance that I assigned to the problem of practice noted, it is important that I explain my positionality as it relates to my personal and professional background and my current role as a scholar-practitioner.

Personal and professional background. Growing up in the 1970s, I had a unique, yet unfortunate, experience that piqued my interest in educational technology. I grew up as a second-
generation American in a large Italian family. Although we were working-class, I had the privilege of attending a wealthy, suburban school district. For many years, I never felt like I fit. I was shy and quiet, and books became my best friends. However, my early childhood teachers seemed to understand me; and I loved going to school. Then, my teacher left on maternity leave, and the principal replaced her with a male substitute. I had difficulty with the transition. When the substitute presented me with the same worksheets we had completed with my beloved teacher, I immediately turned them over and took out my books to read. Soon, I found myself in the special education room in the basement of the school. There, I met a very motherly paraprofessional who did not know what to do with me. I did not qualify for services, and I did not need help reading. She decided to allow me to play on the new Apple computers that no one seemed to want. I was thrilled to place those large floppy disks with educational games such as *Lemonade Stand* and *Oregon Trail* into the drive, and solve problems that were much more engaging than worksheets. Playing on the computer went on for several weeks until my teacher returned. Still, as an elementary student, I knew technology had potential in schools.

My love of learning continued, and I became a first-generation college student. Although I entered as a political science major heading for law school, I switched my major believing I could have a more immediate impact on the world as an educator. Years later, as a high school special education teacher, I continued to understand the value of technology in education for collaboration, communication, critical thinking, differentiation, and engagement. I was fortunate to begin my career in a state of the art career and technical high school, before transitioning to a suburban, comprehensive high school. In both placements, I lobbied and wrote grants to ensure that my students had access to technology that had the power to provide them access to learning that was not otherwise possible. Because of my experiences, I have a strong interest and belief in the
potential of technology to increase engagement, success, and access to the curriculum for students who may struggle to learn through traditional instructional strategies and platforms.

My present role. After sixteen years in the high school classroom, I decided to transition into education administration. For the past nine years, I have served as both a special education director and now as an assistant superintendent for a suburban district. In my current role, I am responsible for overseeing curriculum, instruction, assessment, and professional development.

Recently, our organization increased its focus on technology integration into content and pedagogy. As a district leader, I have been working with students and teachers within my organization in the early stages of technology integration in the classroom. During the 2015-2016 school year, we transitioned from using district-owned devices and student owned devices (BYOD) to a 1:1 Chromebook environment at the high school. The 1:1 solution expanded to all students in grades six through eight in September 2016. As part of this 1:1 initiative, the district created a technology integration plan, to increase access and equity, ensure students acquire 21st century skills and promote deeper learning. As an educational leader within the organization, I fully supported and contributed to this plan and related systems of support.

In supporting and contributing to the plan, I worked closely with the Superintendent and the Director of Technology to define the rationale for 1:1 adoption. Together with our teams, we developed a five-year plan that addressed the rationale for adoption, necessary infrastructure upgrades, hardware, software, curriculum, instruction and professional development. Through the implementation of 1:1, it was our intention to enhance teaching, achieve deeper learning, increase student engagement, ensure the acquisition of 21st century skills, and increase productivity. We never named the device in any of the early planning documents. Instead, we focused on what the administrators, teachers, students and parents would need at various stages of the plan.
We concentrated heavily on communication and conducted over a dozen forums on the rationale and reasons behind the transition. We stressed the importance of the purposeful integration of technology through the provision of innovative professional learning opportunities. These opportunities included workshops, peer-to-peer sharing and learning, walk-throughs, modeling, and coaching. Finally, we supported the integration of technology into content and instruction through curriculum alignment. In every step of the process, we attempted to capture the voices and leadership of teachers and students. As we enter year five of the plan, we are reflecting on the implementation and considering areas of strength and need. While I am hopeful that the implementation plan and rollout have met the intended goals, I recognized the need to understand the perceptions of teachers, students, and administrators to be certain.

**Conclusions.** I recognized that I must own my biases and control for them (Machi and McEvoy, 2012) in my research. Thus, I committed to avoiding what Briscoe (2010) refers to as marginalization through universals. I recognized that like myself, the participants in the study entered with very different experiences and backgrounds related to technology integration, deeper learning, and 21st century skills. These experiences do not make one subset of participants superior to another; it only added to the level of complexity of the problem of practice. Each participant brought with them their unique backgrounds, experiences, and strengths that make up the organization. Although I was a leader within my organization, I fully recognized that the teachers, administrators, students, parents, and community members contribute to the overall successes of the school. They were the subjects in my study, not the objects of study (Briscoe, 2010). As such, I committed “to being open-minded, skeptical, and considerate of the research data” (Machi & McEvoy, 2012, chapter 1, para. 15), as I entered the review of literature and research study.
Research Questions and Purpose Statement

The goals of adopting a 1:1 solution and the integration of technology into teaching and learning should ensure the acquisition of 21st century skills and deeper learning (OECD, 2015). As districts across the country continue to implement 1:1 solutions, understanding the structures and supports administrators, teachers, and students perceive as effective has the potential to ensure implementation success. Moreover, gaining insights into administrator, teacher and student perception about the potential for technology integration to result in the acquisition of deeper learning and 21st century skills, can lead to the greater achievement of intended vision and goals (Friday Institute, 2011; Holcomb, 2009; Topper & Lancaster, 2013). Thus, the overarching research question for this study asked, how teachers, students, and administrators perceive the implementation of 1:1, and its impact on 21st century skill acquisition and deeper learning. As such, the study sought to answer the following questions:

1. How has the district organized itself to support technology integration by teachers with the specific intent of fostering deeper learning and 21st century skills?
2. How do administrators, teachers, and students perceive the implementation of 1:1 and its impact on 21st century skills and deeper learning?

Theoretical Framework

Although districts across the country have adopted 1:1 technology solutions for student learning, research organizations such as the Organisation for Economic Cooperation and Development (OECD, 2015a) note the failure of these same districts to effect change through innovative teaching and learning practices. As such, it is critical that districts develop an implementation plan that defines the expected outcomes, or innovation, they hope to achieve with the integration of 1:1 technology (Friday Institute, 2011; Topper & Lancaster, 2013).
Rogers (2003) suggests that the Diffusion of Innovation (DoI) framework offers a vehicle for practical solutions to organizations considering the implementation of innovation or solution in a “knowledge-utilization process” (p. 105). In understanding the innovative solution of 1:1 for 21st century skills acquisition and deeper learning, this study will examine administrator, teacher and student perceptions regarding the implementation.

**Diffusion of Innovation Explained**

In considering the adoption of 1:1 Chromebooks and impact on teaching and learning, this researcher will employ the DoI theoretical framework (Rogers, 2003) as a lens through which to interpret the findings of the study. As Rogers (2003) notes, “Diffusion is a kind of social change...When new ideas are invented, diffused, and adopted or rejected, leading to certain consequences, social change occurs” (p. 6). Because DoI focuses largely on the concept that the diffusion occurs within complex social systems over time, Rogers’ (2003) framework will provide important insight into the structures, relationships, and people involved in the transition to and implementation of 1:1 teaching and learning.

Rogers states, “Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system” (2003, p. 5). In other words, DoI answers why, how, under what condition, and over what period an organization adopts and re-invents itself through DoI. As Frank, Zhao, and Borman (2004) suggest, “Rogers’ process consists of an independent individual’s knowledge or awareness of an innovation, formation of an attitude toward the innovation, decision to adopt or reject the innovation, implementation of the decision, and confirmation of the decision process” (p. 150). As Frank et al. (2004) stress:

The process is more one of diffusion of innovation within the organization since each actor has some autonomy to make his or her own decision partly in response to the
ideas, information, and other social forces to which he or she is exposed. (p. 150)

Thus, it is essential to understand the perceptions of the members of the organization in the DOI process.

Rogers (2003) indicates that there are four critical elements to this DoI process, which include innovation, communication channels, time, and social systems (Rogers, 2003). This study examined these four components in the context of the district’s transition to 1:1, paying attention to the structures and supports in place, and the perception of the members of the organization relative to these supports and the impact of integration of technology on teaching and learning.

**Innovation.** In this study, the innovation was the adoption of 1:1 Chromebooks for 21st century skill development and deeper learning. As Rogers (2003) notes, “A technological innovation usually has at least some degree of benefit for its potential adopters, but this advantage is not always clear cut to those intended adopters. They are seldom certain that an innovation represents a superior alternative to the previous practice that it would replace, at least when they initially learn about it” (p. 14). Thus, an essential component of the research questions for this study will be to learn the initial perceptions of administrators, teachers, and students relative to the advantage of 1:1 technology integration in teaching and learning. Considering stakeholder perceptions in this study was critically important, especially as it connected to concurrent innovations, or what Rogers (2003) refers to as technology clusters, of 21st century skills and deeper learning. Thus, examining the perceptions of the members of the organization led to greater understanding of the degree of adoption and ownership of the innovation (Rogers, 2003) for enhancing 21st century skill acquisition and deeper learning.

**Communication channels.** When examining any innovation, it is important that researchers also investigate the ways in which the organization communicates the innovation
In considering communication channels, this study investigated the processes that the district took to engage in dialog and shared understanding with the members of the organization. As Rogers (2003) describes, there are four elements the communication process:

1. An innovation,
2. an individual or other unit of adoption that has knowledge of, or has experience with, the innovation,
3. another individual or other unit that does not yet have experience with, the innovation, and
4. a communication channel connecting the two units.

(p. 18)

As such, to understand the perceptions of administrators, teachers, and students, this study structured interview questions to examine how these communication channels, district forums, and connected social systems influenced the perceptions of each stakeholder group. Understanding these communication channels was critical, as Tang and Ang (2002) suggest, “The issues of how schools and teachers perceive the technology and how they adjust are then conceptualized as a form of ‘communication’ [channels]” (p. 462).

**Time.** This study also examined the dimension of time as the district transitioned to 1:1, looking closely at the three elements of “(1) innovation decision-making, (2) individual adoption, and (3) organizational adoption” (Rogers, 2003, p. 170). Through the interview questions posed to the participants, this study considered the five stages in the innovation-decision process (see Figure 1.1) of (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation (Rogers, 2003). Specifically, in attempting to understand the innovation-decision process, the focus group questions asked how the stakeholders learned about the adoption of 1:1, their initial reactions to the adoption relative to their beliefs, practices, and systems of supports, the methods of motivation used to encourage stakeholders to implement the initiative, their personal decisions relative to implementation, the implementation itself, and efforts at continuous improvements, if
Social Systems. Finally, this study examined how the social system of the district reacted in implementing the 1:1 innovation and meeting the previously mentioned objectives of 21st century skill development and deeper learning. As Rogers (2003) stresses, “The structure of a social system can facilitate or impede the diffusion of innovations” (p. 25). In fact, Rogers (2003) notes that few researchers have examined the role of either communication channels or social systems on the diffusion of innovation. In answering the research questions through the extensive use of focus groups, including representatives from the core, embedded units of the organization, this study addressed both the communication channels and the social system.

Figure 1.1. A Model of Five Stages in the Innovation-Decision Process (Rogers, 2003, p. 170).

Rogers (2003) is correct in asserting that it is difficult to “untangle the effects of a system’s structure on diffusion, independent from the effects of the characteristics of the individuals that make up the system” (p. 25). However, in conducting focus groups across the embedded units of
the organization, this study allowed for an understanding of the system effects on the 1:1 initiative. Through the focus group responses, this study revealed the system norms and structures, as well as the influences of opinion leaders and change agents on processes, innovation-decisions, and their results to date (Rogers, 2003).

Thus, in examining these elements of the framework and the five stages in the diffusion of innovation process (see Figure 1.1), this researcher garnered further insights into the perceptions of the participants of the district’s implementation and the potential impact of 1:1 technology on teaching and learning. As such, the DoI theoretical framework (Rogers, 2003), aligned with the research questions posed for this study.

**Limitations**

Although the DoI Framework provided a useful lens in evaluating the research questions presented in this study, as with any framework, DoI has limitations. Rogers (2003) outlines several limitations of the framework, which he categorizes as pro-innovation bias, individual-blame bias, recall problem, and equality. Although these limitations exist, Rogers (2003) offers practical solutions to remediate the potential shortcomings that this researcher addressed in this study.

With DoI comes the potential for pro-innovation bias, or the assumption that the social system of the organization should adopt and expediently carry out the innovation. Further, Tang and Ang (2002) note that the emphasis on DoI tends to be in the organization, rather than on the individual members of the organization who are at the receiving end of the innovation. To remediate identified limitations, this study examined the perceptions of the student recipients of the 1:1 initiative. In addition, Rogers (2003) suggests that conducting research during the process of innovation may offset this bias. Other strategies to account for pro-innovation bias include studying the successful and unsuccessful implementation of innovation concurrently,
acknowledging rejection, discontinuation, and re-invention, investigating the broader context of innovation, and considering the motivation for innovation (Rogers, 2003; Tang & Ang, 2002). Harmancioglu, Droge, and Calantone, (2009) extend the idea of pro-innovation bias, noting that the more difficult innovation is for the members of the organization to adopt, the less likely the organization will fully realize the objectives. Significantly, in the instance of technology in schools, the broader context relates directly to the experiences and perceptions of students and teachers (Tang & Ang, 2002). Thus, it was essential to understand teachers’ experiences with the ease of implementation, as well as their beliefs about the innovation’s advantage over the current processes in place (Rogers, 2003).

DoI can also result in individual-blame bias, where an individual member of the organization becomes the focus of a failed innovation, rather than the organization itself (Rogers, 2003). Rogers (2003) offers several strategies to overcome individual-blame bias, such as including multiple members of the organization, keeping an open mind during investigations, involving those for and against the innovation, and considering the social and communication structures. Per Rogers (2003), to avoid individual blame bias, the researcher included interview questions that investigate the decisions of the individual, the decisions of the embedded group, and the decisions of the organization. In using multiple embedded units within the organization as focus groups, this study worked to avoid individual blame bias.

Further, Rogers (2003) notes that over time, individuals interviewed may not remember the specific events associated with the adoption and implementation of innovation. To correct the problem with recall, a case study allows multiple members of the organization to retell the event, and document review provides evidence of those events (Rogers, 2003). Finally, Rogers (2003) also recommends that researchers use high-quality interview questions, survey questions, and
trained interviewers to account for the recall problem. This research study addressed both strategies relevant to the recall problem.

Finally, DoI may also include issues of equality, resulting in the increase in socioeconomic gaps of the members of the social system, especially in developing nations. As this study occurred in a school system of homogeneous socioeconomic status, and because the organization provided all members the same technologies at no cost, it is unlikely that the diffusion of innovation resulted in an increased socioeconomic gap within the proposed organization.
Chapter II: A Review of the Literature

The Shifting Landscape of Education

The Industrial Revolution and the Agrarian calendar significantly influenced the system of education in the United States (U.S.). The world around us has undergone tremendous transformations since the turn of the century; and yet, education has not kept pace with the innovations, structures, and demands of the 21st century (Mishra, Koehler & Henricksen, 2011). Businesses, career fields, and homes have re-invented themselves to meet the demands of technology-rich environments defined by breakthroughs and innovative practices. Not all schools have. In fact, many continue to exist in the same brick and mortar, factory-like buildings, housing rows upon rows of desks. In these schools, teachers forge-ahead, directing the learning of their students. Their students march forward, absorbing and regurgitating, or not, the knowledge teachers impart. The system remains an industrial model, intended to sort the managers and leaders, from the corps workers. Clearly, “the reality of our schools lags considerably behind the promise of technology” (OECD, 2015a, p. 3). As Columbia University professor and author, Heidi Hayes Jacobs (2010) aptly notes, the clear majority of students travel back in time, each day that they walk through the hallowed halls of their schools.

Importantly, however, the tides of education are beginning to shift to meet the demands of the 21st century. Educators face the stark reality that students are graduating without the requisite skills to be globally competitive in a world where the career fields of yesterday are rapidly disappearing (Koenig, 2011; OECD, 2015a; Project Tomorrow, 2015; Saavedra & Opfer, 2012). Although educators are beginning to recognize the need to change the face of teaching and learning, effective implementation strategies remain elusive. Some educational leaders believe that the provision of 1:1 student technology is the solution to this mismatch between 20th century
educational practices and the demands of the 21st century (Argueta, Huff, Tingen & Corn, 2011; Penuel, 2006; Topper & Lancaster, 2013). Yet, these schools have realized mixed results, at best. In fact, research is clear that “adding 21st century technologies to 20th century teaching practices will just dilute the effectiveness of teaching” (OECD, 2015a, p. 3). Further, without a clear vision, mission, and strategic goals aligned with the integration of technology in schools, students are likely to realize few positive impacts on their achievement (Argueta et al., 2011; OECD, 2015a; Penuel, 2006; Project Tomorrow, 2015; Topper & Lancaster, 2013).

As such, without appropriate planning, structures and supports, many educators are unable to integrate technology to support student 21st century skill acquisition and deeper learning (Argueta et al., 2011; Topper & Lancaster, 2013). Hence, Andreas Schleicher, Director of the Directorate for Education and Skills eloquently notes:

We need to invest in capacity development and change-management skills, develop sound evidence and feed this evidence back to institutions, and back it up with sustainable financing. Last but not least, it is vital that teachers become active agents for change, not just in implementing technological innovation, but in designing them too. (OECD, 2015a, p. 4)

Without a clear vision, access to relevant professional development and reliable resources, teachers are unlikely to transform their teaching practices to become agents of change in the classroom or their broader educational community (Friday Institute, 2011; OECD, 2015a; Penuel, 2006; Topper & Lancaster, 2013).

**A Relevant and Significant Issue**

Throughout this researcher’s career, she has had the opportunity to be a member of organizations, which have afforded their learning community with a continuum of supports,
structures, and resources for the integration of technology to vastly differing degrees. In the organizations that failed to communicate a clear vision and goals, very little changed in teaching practices or experiences of students. Moreover, in the organizations that did not connect 1:1 integration with strong pedagogy, content, and skills, the landscape of teacher-directed classrooms remained the norm. Thus, understanding the perception of administrators responsible for structures and support and the perception of the teachers and students in the learning community is essential in the development and implementation of 1:1 strategies that positively affect 21st century skills and deeper learning. Examining these stakeholder perspectives is especially important, as, although there is some research on the impact of technology on student academic performance, there is limited research on the impact of 1:1 technology solutions on 21st century skill acquisition or deeper learning (OECD, 2015a).

Research in this area will be beneficial as districts continue to adopt and implement 1:1 technology integration solutions. As such, this literature review has the potential to inform decisions about the implementation of 1:1 initiatives through the examination of the perceptions of administrators, high school teachers, and students. In particular, this literature review holds significance for leaders and policy makers responsible for supporting 1:1 solutions. In addition, this study will provide insight into professional development strategies. Research recommends systematic, collaborative professional learning in the delivery of technology integration initiatives (Berrett, Murphy & Sullivan, J. 2012; Jones, Harlow & Cowie, 2004; Keengwe, 2012; Wilsey & Harris, Mishra, & Koehler, 2009).

This literature review also holds significance for teachers responsible for integrating technology into their day-to-day instructional practices and content. The growing body of research suggests that teachers benefit from support, time, and resources in transforming their pedagogical
practices as a critical component of 1:1 initiatives (Ebenezer, Columbus, Kaya, Zhang, & Ebenezer, 2012; Harris, Mishra & Koehler, 2009; Wilsey & Keengwe, 2012). Thus, transforming practice requires continuous reflection, communication, time, and support within collaborative organizations (Fullan, 2006; Rogers, 2003).

Further, this literature review has the potential to provide teachers with information on student perception of transformational teaching practices. Student feedback is a powerful tool that provides teachers with the opportunity to reflect and improve. Ebenezer et al. (2012) note that when teachers engage in professional learning with their students, their instruction improves and student achievement increases. Without an understanding of student perception on 1:1 integration strategies, teachers will be limited in their ability to gauge their technological instructional efficacy (Ebenezer et al., 2012). Thus, this literature review seeks to understand how teachers, students, and administrators perceive the implementation of 1:1, and its impact on 21st century skill acquisition and deeper learning.

To answer this overarching question, this literature review will begin with an examination of the concepts of 21st century skills and deeper learning, paying attention to the utility of technology integration in the classroom. As such, this literature review will provide rich examples of technology integration, 21st century skills, and deeper learning in instructional practices. In addition, this review will explore what it means to integrate technology into pedagogy and content knowledge, following Harris, Mishra and Koehler’s (2009) TPACK framework. Next, the review will evaluate the structures and supports that act as opportunities and barriers to the transformation of teaching and learning in 1:1 environments, with a focus on the experiences of teachers, students, and administrators. Finally, this review will provide an analysis of existing studies that include the
Diffusion of Innovation (DoI) framework in their examination of technology integration, per the four elements of innovation, communication channels, time, and social systems (Rogers, 2003).

**Significance of 21st Century Skills and Deeper Learning**

As previously indicated, the focus on transforming instruction to meet the demands of the 21st century workplace has expanded internationally. Per the OECD (2013), shifts in policy and practice that focus on 21st century skills in education can lead to growth in student achievement. The OECD (2013) stresses that teachers must develop pedagogies that empower students to become effective communicators, risk-takers, collaborators, problem-solvers, and “knowledge workers." (p. 35). Building upon these 21st century skills, the William and Flora Hewlett Foundation (2013), emphasize the need to support essential core competencies including mastery of academic content, critical thinking and problem solving, effective communication, collaboration skills, learning how to learn, and academic mindsets. Collectively, the Hewlett Foundation (2013) and their supporters refer to these competencies as deeper learning. Arguably, the increase of 1:1 devices has the potential to support a transformation of teaching and learning when the focus is on 21st century skill acquisition and the fostering of deeper learning. However, mission-driven technology integration is currently scattered at best (Friday Institute, 2011; Groff, 2013; Harris, Mishra & Koehler, 2009; Mishra et al., 2011; Topper & Lancaster, 2013).

**21st century skills.** Although schools do not engage in mission-driven technology efforts as the norm, educators have recognized the need to prepare students with 21st century skills (Groff, 2013; Kroenig, 2011; OECD, 2015, Project Tomorrow, 2014; Saavedra & Opfer, 2012; William and Flora Hewlett Foundation, 2013). These skills include creativity, collaboration, communication, critical thinking, self-directed learning, and global citizenship (Fullan & Langworthy, 2014; Groff, 2013; Jacobs, 2010; Partnership for 21st Century Skills, 2009; Saavedra
The National Research Council (NRC, 2012) further suggests that 21st century skills include “knowledge that can be transferred or applied in new situations” (p. 23). Included in these competencies are content and procedural knowledge spanning cognitive, interpersonal, and intrapersonal domains that students need to be successful in the 21st century (NRC, 2012).

Groff asks a universally important question, “How can today’s schools be transformed so as to become environments of teaching and learning that make individuals lifelong learners and prepare them for the 21st Century?” (2013, p. 1). This question comes at a time when schools are experiencing a rapid rise in Internet-based devices, with little evidence of pedagogical shifts to match the changing educational landscape (Ertmer & Ottenbreit-Leftwich, 2010; Groff, 2013; Kopcha, 2010). Although research suggests technology integration has some impact on student academic performance as measured by standardized assessments, few studies are available detailing the effect upon 21st century skills or deeper learning competencies (OECD, 2010a).

**21st century skills in the classroom.** Although many educators and researchers agree that students need to acquire 21st century skills to be globally competitive, few have provided a detailed explanation of the requisite instructional strategies necessary to support student acquisition of these skills (Fullan & Langworthy, 2014; Penuel, 2006, Saavedra & Opfer, 2012). Researchers and educators argue that teachers need to consider important pedagogical strategies in 21st century teaching and learning (Fullan & Langworthy, 2014; Mishra, Koehler & Henriksen, 2011; Saavedra and Opfer, 2012). First, Saavedra and Opfer (2012) suggest that teachers need to make the curriculum and lessons relevant to the lives of their students, connecting lessons across disciplines and to real-world applications. For example, rather than teaching the rules of statistics, teachers should model how statistics play a role in areas of student interest such as sports, medicine, and
college acceptance rates. As noted within the relevance strategy, Saavedra and Opfer (2012) further stress that teachers should make cross-disciplinary connections in their instruction. In doing so, teachers may model and coach students across content in skills such as developing oral and written arguments in the presentation of findings in science inquiry. In this example, teachers build upon literacy standards, while instructing students in science content and processes.

Instructing across disciplines is important to the next strategy of teaching for transfer of knowledge (NRC, 2012; Saavedra & Opfer, 2012). Teaching for transfer allows students to apply knowledge, skills, and strategies to novel situations (Fullan & Langworthy, 2014; NRC, 2012; Saavedra & Opfer, 2012). For example, a teacher focused on ensuring transfer might require a student to build a suspension bridge using Computer Aided Design software to support the transport of food supplies in a third-world village, and defend their design. To accomplish this task, students would need to apply knowledge, skills, and strategies related to physics, mathematics, engineering, civics, geography, and argument to a real-life situation.

However, cross-disciplinary learning and transfer are impossible if teachers do not teach students how to learn, including how to become self-directed learners (Fullan & Langworthy, 2014; NRC, 2012; Saavedra & Opfer, 2012). Teaching students how to learn begins with asking them to reflect on how they think and process information (Saavedra & Opfer, 2012). To accomplish this goal in a 21st century classroom, teachers may require students to blog about their learning or add self-feedback to completed work samples. In turn, teachers should provide feedback about the thinking processes and academic attitudes demonstrated by the students (Saavedra & Opfer, 2012).

As such, feedback is a critical element in any classroom (Fullan & Langworthy, 2014; NRC, 2012; Saavedra & Opfer, 2012). However, teachers often forget to provide feedback to negate misconceptions head-on (Saavedra & Opfer, 2012). When teachers address misconceptions,
students can develop new understandings and strategies (Saavedra & Opfer, 2012). For example, in a class where students incorrectly solve a math problem, teachers should help students construct new models that concretely address misconceptions and serve as exemplars for future problem-solving.

In addition to providing students feedback on their individual learning, it is critical that teachers in 21st century classrooms provide students with direct feedback on their ability to collaborate and work as members of a team (Fullan & Langworthy, 2014; NRC, 2012; Saavedra & Opfer, 2012). For example, teachers should design activities that require students to engage in discussion and debate, providing feedback not only on the application of content knowledge but also on student ability to share their thinking and opinions appropriately.

Of course, 21st century instruction requires teachers to integrate technology to extend and enhance learning opportunities (Mishra et al., 2011; Saavedra & Opfer, 2012). Teachers should strategically integrate technology to support student acquisition and practice with communication, collaboration, critical thinking, creativity and global citizenship. For instance, in such a classroom a teacher may require students to engage in an algebra simulation where they must apply their knowledge of mathematical formulas to real-world solutions, such as designing a parking lot that can support a set number of spaces within defined constraints.

Finally, Saavedra and Opfer (2012) argue that instruction must foster creativity in 21st century classrooms. They suggest that creativity spans the other eight strategies and that it is the pinnacle of 21st century skills. In other words, “Creativity is prized in the economic, civic, and global spheres because it sparks innovations that can create jobs, address challenges, and motivate social and individual progress” (Saavedra & Opfer, 2012, p. 12). Mishra et al. (2011) agree with Saavedra & Opfer (2012) regarding the importance of creativity in the classroom. In fact, they
argue that creativity leads to the highest order of thinking skills, or the ability to synthesize to develop innovative and effective solutions to problems, in a technology-rich classroom (Mishra et al., 2012).

Saavedra’s and Opfer’s (2012) comprehensive overview of 21st century instructional considerations align with the pedagogical strategies recommended by Fullan and Langworthy (2014) and the NRC (2012) including, attending to student interests, providing feedback, learning to learn, and peer collaboration. However, Saavedra & Opfer (2012) do not fully explain the relationship between the teacher and student in applying these strategies. Conversely, Fullan and Langworthy (2014) define the instructional strategies or pedagogies “as a new model of learning partnerships between and among students and teachers, aiming towards deep learning goals and enabled by pervasive digital access” (p. 2). Although Fullan and Langworthy (2014) refer to these instructional strategies as “new pedagogies,” they explain that they follow the research of Vygotsky, Piaget, Dewey and Montessori (See Figure 2.1). They argue that “Technology in the new model is pervasive and it is used to discover and master content knowledge and to enable the deep learning goals of creating and using new knowledge in the world” (Fullan and Langworthy, 2014, p. 3).
In other words, through the new pedagogies, teachers act as activators of learning, partnering with their students (Fullan & Langworthy, 2014). In addition, students develop new knowledge and skills that they apply to real-world problems and situations, through 24/7 access to technology in and out of school (Fullan & Langworthy, 2014). Thus, Fullan and Langworthy (2014) contend that 21st century teaching and learning requires more than access to technology and strategies such as blended learning, online courses, and flipped instruction. They suggest that 21st century pedagogy requires teachers to engage as partners with students in the activation of learning, maintaining their expertise in communication, collaboration, critical thinking, creativity and citizenship within and across content areas (see Figure 2.2). Hence, Fullan and Langworthy (2014) note that, “Effective partnering is built on principles of equity, transparency, reciprocal accountability and mutual benefit” (p. 12).
<table>
<thead>
<tr>
<th>Teachers (Pedagogical Capacity)</th>
<th>Students (Deep Learning)</th>
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<tbody>
<tr>
<td>Build trusted relationships with students and peer teachers; seek good mentors</td>
<td>Build trusted relationships with teachers and peers; seek good mentors</td>
</tr>
<tr>
<td>Help students find and build on their interests and aspirations through deep learning tasks</td>
<td>Explore own interests and aspirations in learning goals and tasks</td>
</tr>
<tr>
<td>Require challenging learning goals, tasks and success criteria for self and students that</td>
<td>Develop capacity to define learning goals, tasks and success criteria, partnering in the</td>
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<tr>
<td>require creation and use of new knowledge</td>
<td>learning process</td>
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<tr>
<td>Develop repertoire of teaching strategies; use different strategies to activate learning</td>
<td>Reciprocal teaching and learning from and with peers and teachers</td>
</tr>
<tr>
<td>Provide high-quality feedback and encouragement, especially when students face challenges in</td>
<td>Develop capacity for reflection and perseverance in the face of challenges; provide high</td>
</tr>
<tr>
<td>learning</td>
<td>quality feedback and encouragement to others</td>
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<tr>
<td>Collaborate with other teachers and leaders researching the impact of different learning</td>
<td>Provide feedback to teachers and peers on what is working in one's own learning build</td>
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<tr>
<td>strategies on students (i.e., use an inquiry cycle approach)</td>
<td>mastery of the learning process and one's own progress</td>
</tr>
<tr>
<td>Model a proactive disposition towards learning, creating new knowledge and taking action with</td>
<td>Develop intellectual and attitudinal dispositions towards creating new knowledge and doing</td>
</tr>
<tr>
<td>that new knowledge</td>
<td>things with it in the world</td>
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<tr>
<td>Continuously discover and create digital learning tools and resources to:</td>
<td>Continuously discover and create digital learning tools and resources to explore new</td>
</tr>
<tr>
<td>1) explore new content, concepts, information and ideas;</td>
<td>content, concepts, information and ideas. Use these tools to create new knowledge, to</td>
</tr>
<tr>
<td>2) challenge students to create new knowledge;</td>
<td>connect with peers and experts throughout the world and to use new knowledge in the world</td>
</tr>
<tr>
<td>3) connect with students, peers, and experts beyond the classroom;</td>
<td></td>
</tr>
<tr>
<td>4) accelerate students' ability to drive their own learning process; and</td>
<td></td>
</tr>
<tr>
<td>5) assess and share information on students' learning abilities and dispositions</td>
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</tbody>
</table>

**Figure 2.2.** Teacher and Student Roles (Fullan & Langworthy, 2014, p. 13).

Like Harris, Mishra, and Koehler (2009), Fullan and Langworthy (2014) suggest that teachers apply these instructional strategies through rich tasks. In their study, Fullan and Langworthy (2014), provide the following example of a rich task:

10th grade English students developed and wrote papers on the environment. They could choose any aspect of the environment they wanted, but had to demonstrate writing and communication skills (aligned with Common Core curriculum standards in the United States) alongside knowledge about the environmental issue they chose. After the papers
were completed, students were asked to do something about the issue they had chosen, applying their knowledge to a real situation. One group of boys not known for their love for literature class had written about water pollution. These boys negotiated amongst themselves and chose to address Dog River, which was near the school and had become polluted. They developed ideas for a solution and a plan of action. Then they secured a donation of $3,400 worth of advertising from the local newspaper to build awareness of the issue. They got a local coffee shop to make a special coffee blend to raise funds. And two weeks after school was out – note that this is after ‘grades’ were completed – the kids were out with a local TV station at the river cleaning up the water and describing to viewers what the community needed to do to keep Dog River clean in the future. (p. 23)

Fullan and Langworthy (2014) contend that in applying new pedagogies to rich tasks integrated with technology, teachers can support students in both the acquisition of 21st century skills and deep learning.

**Deeper learning.** As previously noted, deeper learning competencies include mastery of academic content, critical thinking and problem solving, effective communication, collaboration skills, learning how to learn, and academic mindsets (William and Flora Hewlett Foundation, 2013). The NRC (2012) extends this definition of deeper learning “as the process through which an individual becomes capable of taking what is learned in one situation and applying it to new situations (i.e., transfer)” (p. 5). In a detailed report examining these competencies across high schools committed to deeper learning, the American Institute for Research (AIR) does not cite access to technology as requisite to achieving these competencies (Huberman, Bitter, Anthony, & O’Day, 2014). Instead, they find that schools that ensure deeper learning embed opportunities for project-based learning, emphasize mastery of core academic content, focus on interpersonal and
intrapersonal skill development, target learning to learn strategies, develop academic mindsets, and foster cultures that value and support student-centered instructional strategies (Huberman et al., 2014). Like Fullan and Langworthy (2014), they support the idea that technology has the potential to support and enhance previously stated goals and objectives (Huberman et al., 2014).

AIR’s findings align with recommendations from the U.S. Department of Education (2012), suggesting that increasing access to 1:1 digital devices is not a sufficient implementation plan if the goal is to transform teaching and to engage and empower learners (Huberman et al., 2014). Recent research on 1:1 suggests, however, that the purposeful integration of technology has the potential to transform teaching and learning and support the acquisition of skills and competencies aligned with 21st century skills and deeper learning (Project Tomorrow, 2015). As such, significant instructional shifts are necessary to support personalization, individualization, and authentic learning opportunities in technology-rich classrooms (Bonk, 2010; Rosen & Beck-Hill, 2012).

**Deeper learning in the classroom.** The NRC (2012) contends that students reach deeper learning in classrooms that provide positive learning environments that value and support the acquisition of content knowledge along with interpersonal and intrapersonal skills. Like Saavedra and Opfer (2012) and Fullan and Langworthy (2014), the NRC (2012) argues that the development of deeper learning competencies requires the application of learning, opportunities to collaborate, teacher feedback and student self-reflection. Specifically, the NRC (2012) concludes, “The process of deeper learning is essential for the development of transferable 21st century competencies, and the application of 21st century competencies, in turn, supports the process of deeper learning, in a recursive, mutually reinforcing cycle” (p. 8). These deeper learning competencies span the cognitive, interpersonal and intrapersonal domains (Huberman et al., 2014; NRC, 2012). As such, deeper learning competencies (see figure 2.3) include deep content knowledge and critical
thinking/problem solving, communication and collaboration, and academic mindsets and learning to 
learn (Huberman et al., 2014; NRC, 2012; William and Flora Hewlett Foundation, 2013).

![Figure 2.3. Deeper Learning Competencies (Huberman et al., 2014, p. 2).](image)

In examining schools within the deeper learning networks identified by the Hewlett 
Foundation, Huberman et al. (2014) found specific strategies employed across the schools targeting 
the deeper learning competencies in the three domains. They contend that strategiesto build 
competencies in the cognitive domain include setting explicit goals to develop higher order thinking 
skills, aligning teacher-developed curriculum with standards, integrating real-world problems and 
project-based learning (PBL) in instruction, and using formative, portfolio, and exhibition 
assessment strategies (Huberman et al., 2014). Because these deeper learning network schools 
agreed that their purpose was to prepare students for college and career, they all identified a 
commitment to developing students’ higher order thinking skills (Huberman et al., 2014). In 
applying the cognitive domain competencies, schools may require students to complete a short and 
long-term project that span disciplines, align with standards, and require the transfer of knowledge 
and critical thinking (Huberman et al., 2014). For example, a school may require students to 
research and design wind turbines, determine the most effective location for the turbines, and 
develop and deliver a persuasive speech promoting the erection of said turbines to their town
officials. Further, in most instances, deeper learning schools utilized differentiation and personalization to support all learners in achieving the deeper learning competencies within the cognitive domain (Huberman et al., 2014).

Although schools in the deeper learning network employ personalization and differentiation to meet the needs of individual students, they also work to create opportunities to develop interpersonal skills of communication and collaboration (Huberman et al., 2014). In fact, many of the schools’ projects and activities involve teamwork. As such, the schools set explicit interpersonal goals for the students, incorporate collaborative assignments into instruction, and require students to present their work and provide peer feedback as major components of the assessment system (Huberman et al., 2014). In addition to collaborative group work in the classrooms, these schools often engage students in internships, providing opportunities to connect real-world learning to communication and collaboration (Huberman et al., 2014). For example, to achieve the competencies within the interpersonal domain, students engaged in deeper learning might be required to provide critical written feedback using an online format such as Google Docs to a peer, leading to revision and improvement.

Before a student can provide critical feedback to their peers, they first need to develop positive academic mindsets and learning how to learn strategies within the intrapersonal domain (Huberman et al., 2014). In learning how to learn, students develop approaches to tracking their progress and direct their learning (Huberman et al., 2014). Academic mindsets influence the students’ motivation and engagement (Huberman et al., 2014). In schools within the deeper learning network, teachers explicitly work with students on learning how to learn and developing positive academic mindsets (Huberman et al., 2014). Also, they employ instructional strategies such as the use of study groups, peer tutoring, and mentoring, individualization, offering student
choice, and encouraging the self-monitoring of progress to make learning visible (Huberman et al., 2014).

Further, to engage students in deeper learning, the NRC (2012) argues that instruction should include research-based teaching methods. Like Fullan and Langworthy (2014), they link these strategies to the work of educational researchers, including Vygotsky, Dewey, Montessori, Bloom, and Piaget. Specifically, the NRC (2012) recommends that teachers use multiple representations and models, require students to elaborate, question, and explain, engage students in rich tasks, employ examples and case studies in instruction, motivate students. The NRC (2012) contend that activities relevant to student interests, background and real-world problems motivate students. Also, the NRC (2012) encourages teachers to use formative assessment to provide feedback, encourage self-reflection, and drive instructional decisions. In addition, the NRC (2012) contends that teachers must directly instruct students on the metacognitive skills required to problem-solve and that these metacognitive skills promote deeper learning, allowing students to transfer knowledge across situations (NRC, 2012).

**Deeper learning in schools.** Huberman et al. (2014) found that schools successful in supporting deeper learning, targeted their overall structures and culture, in addition to promoting the instructional strategies previously explained across the domains. Some of the common school structures include the use of advisory to support personalization and positive relationships, creative scheduling to support PBL, internships, and interventions, and personalized school cultures structured around small classes and teams of teachers and students (Huberman et al., 2014). For example, at Big Picture Schools, all students work within an advisory of approximately twelve students to learn content, collaborate, and develop as learners. In addition, the students develop relationships with mentors through internship programs designed to support their exploration of
complex, real-world problems. Students self-select projects and present their learning in formal exhibitions multiple times per year. Through the structure and culture of the school, students meet the explicit goals within the three deeper learning domains and six competencies. As evidenced by the example of Big Picture Schools, significant instructional shifts are necessary to achieve 21st century skills and deeper learning.

**The Integration of Technology into Pedagogy and Content Knowledge (TPACK)**

As previously noted, although most studies do not cite technology integration as necessary to achieve deeper learning and 21st century skills, they do suggest that careers require technological competence that includes 21st century skills and deeper learning competencies (Huberman et al., 2014). To achieve necessary instructional shifts for 21st century skills and deeper learning competencies in technology-rich classrooms, educators must focus on the integration of technology into pedagogy and content. Although few studies exist surrounding successful implementation strategies for the integration of 1:1 technologies into content and pedagogy, nascent research points to the significance of the TPACK framework in supporting the instructional skills necessary for transformational change in technology-rich environments (Harris et al., 2009; Mishra et al., 2011).

Since, per the Organization for Economic Cooperation and Development (OECD, 2013), limited evidence exists of widespread transformations of teaching and learning, it is critical that educators examine this research closely.

The TPACK framework illustrates the intersection and interplay between technology, curriculum, and pedagogy to explain teachers’ understanding of the role of each area in research-based teaching connected to their content. Harris et al. (2009) use the illustration below (see Figure 2.4) to provide a visual of the intersections between content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). Surrounding the intersections of CK, PK, and
TK is the context in which teaching and learning occur. Harris et al. (2009) further emphasize that the relationships between CK, PK and TK lead to further and more complex interactions noted as pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK).

Because, "The intersection of technology, pedagogy, and content knowledge (TPACK) is at the heart of effective technology integration" (McAnear, 2009, p. 5), it is imperative that leaders stress the overlap between technology, content, and pedagogy (Harris et al., 2009). Further, since TPACK is central to instructional practices, "Teachers need to develop fluency and cognitive flexibility not just in each of these key domains -content, technology, and pedagogy- but also in the manners in which these domains interrelate, so they can affect maximally successful, differentiated,
contextually sensitive learning" (Harris et al., 2009, p. 402). Harris et al. (2009) argue that in the past none of the strategies for technology integration addressed the pedagogical practices to meet curriculum-based objectives (Harris et al., 2009).

**Transforming Teaching and Learning in 21st Century Classrooms**

Harris et al. (2009) contend that it is essential that teachers revisit content and pedagogical knowledge, in conjunction with technological knowledge. A clear path toward the integration of technological and content knowledge is through a constructivist teaching approach (Fullan & Langworthy, 2014; Keengwe & Onchwari, 2011; Zhao, 2012). Constructivism requires teachers to provide students with opportunities to make meaning from their learning and engage in hands-on inquiry. In citing Jonassen, Keengwe, and Onchwari state, "In the constructivist perspective, learning with technology supports thinking in meaningful ways" (2011, p. 3). This approach also supports teachers as they differentiate their instructional approaches to reach all students (Keengwe & Onchwari, 2011). Further, Keengwe and Onchwari indicate that "Constructivist teachers ask questions, oversee activities, and mediate class discussions; the instructional process is viewed as supporting construction rather than the exchange of knowledge" (2011, p. 3). They posit that technology integration should support the objectives identified in the curriculum. Also, it should demand timely, specific, and meaningful feedback for students (Huberman et al., 2014; Keengwe & Onchwari, 2011; NRC, 2012). Further, Keengwe and Onchwari (2011) contend that teachers should personalize technology to focus on inquiry and authentic learning. Thus, the constructivist approach aligns with deeper learning competencies and its related key research findings (Fullan & Langworthy, 2014; Huberman et al., 2014; NRC, 2012; William and Flora Hewlett Foundation, 2013).
Significantly, in a study of classroom technology integration, Debele and Plevyak (2012) found that "The main conditions for the success of classroom technology integration had to do with the strength of pedagogy-technology alignment and the supportive purposes of the researcher when developing the projects" (p. 295). In such classrooms, researchers note opportunities for innovation-based explorations, rather than goal-derived applications of technology (Debele & Plevyak, 2012; Fullan & Langworthy, 2014; Zhao, 2012). By focusing on projects and rich tasks that cross disciplines, teachers can help students transfer knowledge and skills across situations (Fullan & Langworthy, 2014; NCR, 2012; Mishra, et al., 2011). In fact, Mishra et al. (2011) contend that “Trans-disciplinary knowledge helps students move beyond looking for one “correct” solution, towards an approach that integrates different solutions, viewpoints, or perspectives” (p. 24). They argue that skills students must transcend knowledge across disciplines is essential in 21st century classrooms (Mishra et al., 2011).

Mishra et al. (2011) explain strategies that support trans-disciplinary learning in technology-rich classrooms include “perceiving, patterning, abstracting, embodied thinking, modeling, deep play/transformational play, and synthesizing” (p. 24). Mishra et al. (2011) indicate that perceiving involves observing and imaging. For instance, in a technology-rich classroom, teachers might have students view a video of animals in their actual habitat; adding complexity to what would be possible from reading a textbook explanation of the same science concepts. Patterning moves beyond perceiving and expects students to not only recognize patterns but also create their following rules and constraints (Mishra et al., 2011). For example, students may use Computer Aided Design software involving mathematical measurement and ratios to construct an architectural design. Next, using abstracting, students work to understand the essential aspects of a concept, which may involve developing comparisons or analogies (Mishra et al., 2011). For
example, in technology-rich classrooms, students may demonstrate their ability to abstract concepts by publishing poetry or creative writing pieces that illustrate their thinking. Also, students may engage in embodied thinking, combining kinesthetic thinking and empathizing (Mishra et al., 2011). In combining embodied thinking and technology, students may use drag and manipulation features of the software to test out math functions or to create different musical beats. Finally, in synthesizing their thinking, students pull together all of the previously described strategies to develop an in-depth understanding of a concept, an idea, or a problem (Mishra et al., 2011). In all the examples cited within this section, teachers skillfully follow the TPACK framework to transform teaching and learning (Mishra et al., 2011).

To build skills with technology integration into content and pedagogy, literature also reveals collaboration and mentoring as successful strategies (Kopcha, 2010; Ertmer & Ottenbreit-Leftwich, 2010). Rather than focusing on how to instruct with technology, using mentoring and collaboration allows leaders to target the empowerment of teachers to meet their identified goals and objectives (Ertmer & Ottenbreit-Leftwich, 2010; Kopcha, 2010). Empowering teachers to integrate technology is essential, as confidence, skill, and autonomy will support a change in belief systems that have acted as barriers to transformational instruction (Huberman et al., 2014; Keengwe & Onchwari, 2011, Ertmer & Ottenbreith-Leftwich, 2010).

Technology and the Acquisition of 21st Century Skills and Deeper Learning

The purposeful integration of technology has the potential to support student collaboration, communication, creativity, and critical thinking skills, which are requisite for the 21st century (Fullan & Langworthy, 2014; Groff, 2013; Jacobs, 2010; Partnership for 21st Century Skills, 2009; Zhao, 2012). Further, these skills, combined with opportunities for PBL, application of learning of real-world problems, and focus on academic mindsets and learning how to learn, have the potential
to foster deeper learning in ways not possible without the integration of technology (Fullan & Langworthy, 2014; Huberman et al., 2014; William and Flora Hewlett Foundation, 2013). Yet, barriers to technology integration continue to exist.

**Potential Barriers.** Although leaders have reduced many barriers to technology integration, they have not eliminated them. Educational leaders must recognize that teachers have related fears that require embedded professional development, shared collaboration, time, and supports to overcome (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Further leaders need to establish structures and policies to guide students, teachers, and parents (Hatakka, Andersson & Gronlund, 2013). Without such strategies, there is little chance of transforming teaching and learning through the diffusion of technology integration to meet the demands of the 21st century.

Studies suggest that teacher beliefs may result in resistance to change (Keengwe & Onchwari, 2011), effectively preventing transformative practices. Notably, teachers perceive a lack of technology support, climate, and culture of their schools as barriers to the effective integration of technology. Research studies also illustrate teachers perceive professional development, time, leadership, policies and organizational structure as barriers (Jones et al., 2004). These barriers involve the complexity of teaching, including the wide array of student needs, competing organizational demands, initiative overload, degrees of alignment between curriculum, pedagogy, and assessments, and teacher preparation (Frank, Zhao, Penuel, Effeson & Porter, 2011).

Berrett, Murphy, and Sullivan (2012) argue that technology initiatives have largely been top down, leading to teacher perceptions previously outlined. Significantly, the success of innovative initiatives depend on the leadership and the culture of the schools (Huberman et al., 2014; Kopcha, 2010). As well as the opportunity for collaborative teacher participation in the decisions and
implementation (Hung, Shu-Shing, and Lim, 2012; Inan & Lowther, 2010; Kopcha, 2010; Keengwe & Onchwari, 2011). Often, administrators roll out technology initiatives without careful study or clear expectations and policies (Friday Institute, 2011). A lack of clear expectations creates friction with teachers, resulting in barriers that need to be overcome (Berrett et al., 2012).

**Strategies to Overcome Barriers.** Although barriers exist, research suggests viable strategies that overcome the roadblocks noted in the successful implementation of 1:1 learning environments. These strategies directly address issues related to collaboration, communication, professional development, organizational structure, and policy considerations.

First, as Kopcha (2010) indicates, teachers are more likely to integrate technology if the culture and supports are in place for a systemic, collaborative process. Moving toward technology integration using such an approach has a greater likelihood of building capacity and sustainability (Huberman et al., 2014; Kopcha, 2010). As such, it is critical that decision-makers evaluate and match the school’s inclination for implementing and adopting an innovation with the level of difficulty of the innovation. If “the complexity exceeds the readiness,” the likelihood of sustained implementation decreases (Hung, et al., 2012, p. 60).

Keengwe and Onchwari (2011) also contend that it is critical that leaders provide opportunities for teachers to learn, plan, explore and collaborate around technology integration. When organizations develop such a framework for collaboration, diffusion, and scaling of the innovation is possible through continuous improvements (Hung et al., 2012). Essential to the collaboration, Wilsey and Keengwe (2012) recommend teachers review the curriculum for technology integration opportunities. In so doing, they suggest teachers consider the goals of the program, content, and pedagogy. As Dunleavy, Dextert, and Heinecket (2007) note, this review includes understanding what pedagogical practices, classroom management strategies, assessment
methods and resources are most effective in 1:1 settings. To integrate technology into pedagogy and content, teachers must review the objective and determine the learning activities and tasks best suited for teaching and learning the specific content (Harris et al., 2009; McAnear, 2009). Such an approach positively affects student learning, as it enhances student access to learning through "flexible goals, methods, materials, and assessments that accommodate learner differences" (McAnear, 2009, p. 5).

Still, professional development is necessary. Teachers require training on new pedagogies aligned with content and technology (Harris, 2012; Harris et al., 2011). To maximize the impact of professional development, leaders should allow personalization to ensure these opportunities meet the needs of the individual teacher. Debele and Plevyak stress that, "teacher educators should be deliberate about developing their own expertise with using technology in their own classrooms, and should maintain a supporter role when they co-design projects with school teachers" (2012, p. 296). For example, in Debele and Plevyak’s (2012) study, the projects that involved greater collaboration were more successful. Thus, strong collaborative partnerships in a supportive school culture support integration (Debele & Plevyak, 2012; Fullan & Langworthy, 2014; Huberman et al., 2014; Hung et al., 2012; Kopcha, 2010).

Equally important to involving teachers in the process of transitioning to 1:1 teaching and learning environments, is the involvement of the students (Fullan & Langworthy, 2014). Research suggests that student-teacher collaboration and training be a regular occurrence in schools (Argueta et al., 2011; OECD, 2015a; O’Hanlon, 2008). Further, O’Hanlon (2009) and the OECD (2015a) note the importance of training students on digital citizenship and cyber safety.

Finally, the review and establishment of 1:1 policies are essential to eliminating implementation barriers. Organizations should decide on innovations and policies after the
inclusion of a deep analysis of case studies within and across organizations (Hung et al., 2012).

O’Hanlon (2009) and the OECD (2015a) suggests that leaders continuously review policies. This review should consider the acceptable use policy, the financial implications of 1:1, the broadband and capacity issues of the wireless network, teacher training, and student equity and access issues (O’Hanlon, 2009; OECD, 2015a). These policies are critical to the successful, safe and equitable implementation of 1:1 learning environments (OECD, 2015a).

**Leadership Strategies Affecting Students and Teachers**

In addition to policy, enhancing the technology integration skill and confidence of teachers to transform their pedagogical practices is an important, yet complicated and challenging process (Mishra et al., 2011). Leaders can develop teacher confidence with technology integration through professional networks and positive school culture during both pre-service training and professional development (Ertmer & Ottenbreit-Leftwich, 2010; Kopcha, 2010). Teachers need the opportunity to observe, collaborate, and practice technology integration strategies to increase their self-efficacy and mastery of these pedagogical approaches (Ertmer & Ottenbreit-Leftwich, 2010; Lee & Tsai, 2010). Research stresses the importance of the collaborative aspect of building teacher confidence and pedagogical skills (Mishra et al., 2011). As such, Antonietti and Giorgetti (2006) note that teachers are most willing to adopt and integrate technology when colleagues assure them that the strategy will support them in reaching an educational objective with their students.

**Student Engagement.** As teachers engage in professional development and move toward a more defined role as a coach, facilitator, and activator of learning, the student’s role shifts (Fullan & Langworthy, 2014; Groff, 2013). Students need to take more responsibility for their learning, as teachers provide them with more authentic and self-directed learning opportunities (Fullan & Langworthy, 2014; Hatakka, Andersson & Gronlund 2013). For students to take ownership of their
learning, teachers should empower them as collaborators in lesson design (Ebenezer, et al., 2012; Fullan & Langworthy, 2014; Groff, 2013; Hatakka, Andersson and Gronlund, 2013).

In 1:1 environments framed around deeper learning, students engage in meaning making through choice and self-directed learning (Fullan & Langworthy, 2014; Hatakka, Andersson & Gronlund; 2013). Research stresses that for students to make meaning of their learning, teachers need to provide them with hands-on, active learning opportunities supported by technology within the social context of the classroom (Keengwe & Onchwari, 2011; Mishra et al., 2011). According to Hatakka et al., "By being able to make their own choices they have become more autonomous in the learning process- something which also fosters their creativity and analytical ability” (2013, p. 102).

As students experience increased engagement and empowerment through choice and hands-on learning, schools must support students with policies and clear expectations to avoid the potential challenges that could lead to distraction, health strain, safety, and social behavior issues (Hatakka et.al, 2013). When pedagogical practices, policies, and clear expectations engage and empower students with technology, students experience growth as learners. Students develop the capacity to build new knowledge, direct their learning, increase perseverance, and become lifelong learners (Fullan & Langworthy, 2014). For these new pedagogies to engage and empower learners, teachers need support and frameworks to guide their transformation (Groff, 2014).

**Teacher Beliefs and Self-Efficacy.** Educational leaders must consider many aspects to teaching and learning guided by the new frameworks. Importantly, when teachers have autonomy and self-efficacy, they are more motivated and able to address adaptive challenges (Skaalvik & Skaalvik, 2014). Yet, self-efficacy and autonomy have a different meaning for teachers depending on their experience and mastery of teaching with technology (Lee & Tsai, 2010; Skaalvik &
Ironically, greater autonomy motivates teachers with low self-efficacy more than those with high self-efficacy (Skaalvik & Skaalvik, 2014). Differences in motivation may be because teachers with low self-efficacy are not comfortable sharing their weaknesses. However, teachers with high self-efficacy do appreciate autonomy as well (Skaalvik & Skaalvik, 2014). "Teachers with strong mastery expectations may perceive autonomy as an opportunity to teach according to their own values, to use their resources, to experiment with new practices, and to change practices to the situation and students' needs" (Skaalvik & Skaalvik, 2014, p. 76).

Teacher beliefs and connections to their past practices may be barriers to pedagogical shifts, without a balance of support and autonomy to realize true transformational change. Unfortunately, research reveals that teachers’ beliefs are stable and may not be prone to change (Antonietti & Giorgetti, 2006). Further, teacher beliefs and perceptions influence their level of technology integration (Mishra et al., 2011). As Antonietti and Giorgetti (2006) contend, teachers’ perceptions related to their expertise, access to computers, and beliefs about the potential impact of technology on teaching and learning, are the greatest determiners of use. Although the review of the literature revealed that teacher beliefs are difficult to change (Antonietti, & Giorgetti, 2006), it is essential that leaders in technology-rich environments focus on transforming belief systems that are counterproductive to 21st century teaching and learning. One way to transform the belief systems is to build the connection between student-centered practices of authenticity, choice, and collaboration in technology-rich environments (OECD, 2015a). In fact, the OECD (2015a) stresses, “The evidence from PISA supports the conclusion that teachers who are more inclined and better prepared for student-oriented teaching practices are more willing to integrate computers into their lessons” (p. 75). Ertmer et al. (2012) state that teachers who have student-centered beliefs, adopt
constructivist practices aligned with 21st century expectations and deeper learning in spite of technological, administrative, or assessment barriers.

As the research suggests, teachers’ beliefs have the greatest impact on their pedagogical practices. Factors connected to the beliefs that support the integration of technology include self-reported problem-solving mindsets, external supports, and collaboration. On the other hand, factors that present barriers to the integration of technology include self-reported attitudes and beliefs about technology and perceptions of technological knowledge and skills (Ertmer et al., 2012; Keengwe & Onchwari, 2011; Inan & Lowther, 2010). Shifts in beliefs are possible when teachers recognize increased access, student learning, curricular connections, and support from colleagues, administrators and external networks (Ertmer et al., 2012). Notably, research indicates that school-level collaboration, support, and culture significantly influence 1:1 integration (Hung et al., 2012; Inan & Lowther, 2010). Because of school level supports, teachers can experiment with technology integration and reflect on the impact on teaching and learning.

Administrators must have the skills to support teachers, while offering teachers opportunities to provide feedback about their needs (Argueta et al., 2011). Further, it is critical that leaders support teachers with targeted professional learning opportunities (Argueta et al., 2011; Stošić & Stošić, 2013), as well as opportunities for collaboration and peer-to-peer sharing and learning (Holcomb, 2009; Hung et al., 2012). When administrators and teachers work collaboratively toward common, agreed upon goals, it is more likely that the 1:1 solution will lead to the purposeful integration of technology into teaching and learning (Holcomb, 2009; Topper & Lancaster, 2013).

Professional development. Although research indicates a need to shift to more student-centered teaching approaches, teachers may not have the acquired skills to transform practice,
without support from leadership and training opportunities (Keengwe & Onchwari, 2011).

Adoption and transformation vary from teacher to teacher based upon their beliefs and skills (Ertmer et al., 2012; Kopcha, 2010). Kopcha (2010) recommends a model of technology integration professional development that addresses teacher skills, beliefs and time.

New models of professional learning are critical since traditional professional development has been primarily a one-session delivery model approach that does not get to the true heart of change (Bonner, 2006). Ertmer et al. (2012) suggest that professional development focus on strategies that facilitate changes in attitudes and beliefs. For this to occur, professional development must be ongoing, address teacher beliefs and create a technology supportive school environment (Inan & Lowther, 2010). The models for this approach can include mentor programs (Kopcha, 2010) or “formal and informal learning strategies, including community services, training courses, [and] information events” (Gripenberg, 2011, p. 303).

According to Harris et al. (2009), whatever the professional development model is, leaders need to use TPACK to frame the learning. They suggest learning activities that focus on content and pedagogy. Further, Harris et al. (2009) emphasize that facilitators should address differences in content areas. They recommend beginning with activities familiar to the teacher and upgrading those activities using technology. Thus, Harris et al. propose, "TPACK-related activity types for teachers' use should be conceptualized and presented regarding their specific disciplinary discourses and conjunction with their technological affordances" (2009, p. 405).

Moreover, districts must differentiate professional development to meet the needs of the individual teacher (Ertmer et al., 2012; Frank, Zhao, Penuel, Effeson, & Porter, 2011; Kopcha, 2010). Frank et al. (2011) suggest effective "professional development that positively affected teacher acquisition of knowledge and skills include a focus on content knowledge and coherence
with other learning activities and with teachers' goals for professional development" (p. 139). For this to occur, teachers need opportunities to experiment using constructivist approaches that are context specific. Frank et al. (2011) emphasize that professional development that allows for collaboration and peer-to-peer learning is critical. They argue that ongoing coaching, support, and reminders are key to sustainability (Frank et al., 2011).

Finally, Kopcha (2010) stresses that mentoring is one method of offering systemic coaching and support. He suggests that such a model removes the barriers of “time, beliefs, access, professional development and culture” (2010, p. 175). Further, Kopcha recommends modeling and developing teacher leaders. The development of teacher leaders leads to a learning community that supports student-centered teaching and learning in a technology-rich environment (Kopcha, 2010). Thus, it is through such a supportive learning community that innovations in teaching and learning are not only possibly, but spread throughout day-to-day practices.

**Existing Studies on Diffusion of Innovation (DoI) and Technology Integration**

Diffusion is difficult to achieve. Schools often can articulate the innovative practices and outcomes that they would like to achieve; however, implementation continues to be an area of struggle (Frank, Zhao, & Borman, 2004). Even when the organization clearly defines and communicates the innovations, they rarely realize the expected outcomes (Frank et al., 2004). As Frank et al. (2004) note, attention must be given to the organization’s structures and social systems to affect innovation and change. Because “Innovation is the requirement that the school does not remain at the traditional level” (Stošić & Stošić, 2013, p. 5), this section will review research examining the Diffusion of Innovation (DoI) in schools.

The innovation. In a quantitative study of 57 elementary teachers and 105 secondary teachers, Stošić & Stošić (2013) found that innovation in education is not the current norm, nor is it
greatly emphasized as a priority. These findings, framed by DoI, suggest that the lack of innovation is largely the result of limited access to experts in innovation, as was the failure of the organization to prepare their infrastructure or teaching staff (Stošić & Stošić, 2013). Thus, teachers may not feel comfortable with implementing innovative practices (Stošić & Stošić, 2013). As such, teacher preparation and support are critical elements in bringing innovation to scale, transforming the landscape of teaching and learning (Stošić & Stošić, 2013).

**Communication channels.** Although teacher preparation is a critical factor in the adoption and implementation of innovation, it is not the sole factor. In fact, teacher understanding is also essential because “The choice to adopt a new technology requires the knowledge that it exists and information concerning its suitability to the potential adopter’s situation” (Levin et al., 2012, p. 1774). Specifically, Levin et al. (2012) note that the rate at which innovation takes hold in an educational organization is highly dependent upon the communicated objectives, needs, and resources available to the organization.

**Time.** One of any organization's most scarce resources, time, is a critical factor in adoption, implementation and capacity building of innovation. As Kebritchi (2010) suggests in her study of the adoption of educational games, schools need to inform teachers of the purpose and significance of the adoption. In helping teachers understand the purpose of the innovation, teachers are more likely to provide the time needed for the innovation (Kebritchi, 2010). Further, the school should honor teacher-time, and create opportunities for communication, collaboration, professional learning, implementation practice, and implementation improvements (Kebritchi, 2010). In fact, Kebritchi (2010) found time to be a potential barrier to innovation adoption and implementation.

**Social Systems.** Since innovation diffusion lays in the hand of people, Frank et al. (2004) contend, “Change agents should attend to local social capital processes that are related to the
implementation of educational innovations or reforms” (p. 148). Other than declaring that teachers require professional development, leaders and researchers have not closely examined other critical factors in the implementation of innovation. Frank et al. (2004), adhering to the DoI framework and Bourdieu’s (1986) theory of social capital, suggest that leaders and researchers give attention to the social system within the organization, as numerous initiatives at play can place an inordinate strain on these systems.

In trying to understand the impact of the social system on innovation, Frank et al. (2004) researched schools in the process of implementing computer integration. Frank et al. (2004) began with the assumptions that the individuals within the organization of the school depend on that organization for resources and structural supports. Further, they posit that individuals can place pressure on one another to ensure the success or failure of an initiative (Frank et al., 2004). As such, the perceptions and beliefs of the members of the organization regarding the purpose of 1:1 are critical to the success or failure of the integration of technology. Since communication and collaboration is a reciprocal process, members of the social system of the organization continuously influence one another (Frank et al., 2004). Frank et al. (2004) suggest that this reciprocal process includes talking, helping one another, and placing positive or negative social pressure.

In a wide-scale study of 250 research projects across the education system in Singapore, Hung, Shu-Shing, and Lim (2012) also concluded that the social systems, or Communities of Practice, of an organization, are critical to DoI. Hung et al. (2012) posit that top-down innovation is ineffective and not sustainable. They argue that two-way dialog and peer-to-peer learning and sharing are essential because diffusion is not a linear process (Hung et al., 2012). Hung et al. (2012) further suggest that when teachers are involved in the innovation research process, they have ownership and the requisite professional learning necessary develop, implement, and bring the
adoption to scale. Moreover, Hung et al. (2012) emphasize that when school systems involve their entire community in a non-linear implementation process, the system has a strong chance of progressing toward 21st century skills. Thus, culture building, including the collective commitment to vision and mission is essential.

Organizational balance and purpose. The collective commitment requires a focus on the innovation and its purpose, communication, and feedback related to that innovation, time to develop, implement and refine that innovation, and the buy-in from members of the social system. This organizational view of DoI is well-documented by Trentin’s (2012) analysis of research studies across educational organizations in Europe. In his study, Trentin (2012) suggests the diffusion and sustainability of innovation are dependent upon three major factors. First, the organization must provide a balance between their focus on the pedagogy of the classroom and the andragogy of professional development (Trentin, 2012). Next, Trentin (2012) contends that the organization must manage itself in such a way that the innovation becomes an integrated part of the system, not a voluntary add-on. Finally, Trentin (2012) posits that the organization must also focus on the integration of individual applications, as well as the innovation as a whole.

In reviewing a study from The Institute of Educational Technology of the Italian National Research Council, Trentin (2012) notes organizations value innovations when “the methodological and pedagogical perspective focused on how the design and co-evaluation of new learning activities and technologies can provide solutions to concrete teaching and learning problems” (p.56). As such, Trentin’s (2012) findings support earlier research, suggesting that innovations diffuse and are sustained when organizations develop a clear vision for their innovation that is valued by their members, communicate frequently to stakeholders, afford time for development, implementation
and revision, and support the social systems (Frank et al., 2004; Kebritchi, 2010; Levin et al., 2012; Stošić & Stošić, 2013).

Summary

This literature review explored the phenomenon of 1:1 learning environments in schools. Further, the review investigated 21st century skills, deeper learning, and their relevance to the integration of technology into pedagogy and content in the classroom. In addition, the review analyzed the supports and barriers to the transformation of teaching and learning, with a focus on the experiences of teachers, students and administrators. Finally, this review provided an analysis of the few existing studies that include the Diffusion of Innovation (DoI) framework in their examination of technology integration.

As previously discussed, the world is more globally connected, and the skills that students require to become viable candidates for college and career have drastically changed (OECD, 2013). Teachers must learn how to prepare students with 21st century skills, including collaboration, communication, critical thinking, creativity, and global citizenship (OECD, 2013; Partnership for 21st Century Skills, 2009; U.S. DOE, 2010). Thus, teachers must make a shift to pedagogical paradigms that embrace deeper learning competencies. In such an approach, students have the opportunity to construct new knowledge, engage in inquiry, become self-directed learners, create for authentic audiences, solve problems, and have a voice in their learning (Fullan and Langworthy, 2014; Groff, 2013; Huberman et al., 2014; Jacobs, 2010; OECD, 2013; William and Flora Hewlett Foundation, 2013; Zhao, 2012). To address these challenges, many school districts are implementing 1:1 solutions.

Although schools are turning to 1:1 computing as the solution, 1:1 is failing to lead to transformative change (OECD, 2015a; Project Tomorrow, 2015). As such, research that is more
recent focuses on the integration of technology for the express purpose of building students’ 21st century skills. These skills include communication, creativity, collaboration, critical thinking, and global citizenship (Fullan & Langworthy, 2014; P21, 2009). Taken alone, these skills have the potential to support students in the 21st century global landscape. Reaching these skills requires schools to hone in on the deeper learning competencies of academic mindsets, content knowledge, critical thinking, collaboration, communication, and learning how to learn (Huberman et al., 2014; William and Flora Hewlett Foundation, 2013). Moreover, to support the student acquisition of these 21st century skills and to foster deeper learning, studies suggest that teachers must incorporate student-centered teaching practices, including PBL and the application of real-world problems into their instruction (Huberman et al., 2014; William and Flora Hewlett Foundation, 2013). Still, more research is needed to understand the impact of these pedagogical strategies on students cognitive, interpersonal, and intrapersonal skills defined by deeper learning and 21st century skills.

Shifting pedagogical approaches within new learning environments poses unique challenges for teachers (Groff, 2013). The research is clear that teachers need professional development and the support of leaders in making this complicated transition (Ertmer et al., 2012; Keengwe & Onchwari, 2011; Wilsey & Keengwe, 2012). New models of professional learning are critical since traditional professional development has been primarily a one-session delivery model approach that does not get to the true heart of change (Bonner, 2006). Ertmer et al. (2012) suggest that professional development focus on strategies that facilitate changes in attitudes and beliefs. For this to occur, professional development must be ongoing, address teacher beliefs and create a technology supportive school environment (Inan & Lowther, 2010). As such, it is essential that further research is conducted to understand the supports and structures that benefit teachers in the successful integration of technology into content and pedagogy.
As school districts implement 1:1, understanding the elements of Diffusion of Innovation, including the innovation, communication channels, time, and social systems, has the potential to reveal potential barriers and strategies for implementation success (Frank, et al., 2004; Kebritchi, 2010; Levin et al., 2012; Stošić & Stošić, 2013). Research suggests that innovations diffuse and scale when organizations develop a clear vision valued by their members, communicate frequently to stakeholders, afford time for development, implementation and revision, and support the social systems (Frank et al., 2004; Kebritchi, 2010; Levin et al., 2012; Stošić & Stošić, 2013; Trentin, 2012). As such, understanding the elements of DOI through further research is critical is examining the impact of mission and vision driven 1:1 initiatives on teaching and learning.
Chapter III: Methodology

This case study, on the district referred to as Greendale Public Schools, sought to answer how teachers, students, and administrators perceive the implementation of a 1:1 technology integration initiative and its impact on their teaching and their students’ learning. The case study methodology is well suited to addressing the problem of practice detailed above because “The case study offers a framework for investigating complex social units containing multiple variables. Grounded in real-life context, the case study, as a holistic, life-like account offers insights and illuminates meanings” (Merriam, 1985, p. 210). Thus, in linking the Diffusion of Innovation (DoI) theoretical framework with the current practices of the study site, the researcher increased her knowledge and understanding of the identified phenomenon, resulting in research-based findings (Culpin & Scott, 2011). Specifically, the researcher investigated her problem of practice across the high school’s core content areas, examining a teacher, student, and administrator perceptions (see Table 3.1). As the purpose of this study was to understand the teacher, student and administrator perceptions of 1:1 structures and supports, as well as the potential impact of technology on deeper learning and 21st century skills, a qualitative research method was appropriate.
Table 3.1

Focus Group Participants

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Focus Groups</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrators</td>
<td>Building Administrators: Principal and Assistant Principals</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>District Administrators: Superintendent, Director of Administration, Director of Pupil Personnel and Director of Technology</td>
<td>4</td>
</tr>
<tr>
<td>Core Teachers</td>
<td>Math Teachers</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Science Teachers</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Social Studies Teachers</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>English Teacher</td>
<td>4</td>
</tr>
<tr>
<td>Students</td>
<td>Upper Classmen – Grades 11 and 12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Underclassmen – Grades 9 and 10</td>
<td>11</td>
</tr>
</tbody>
</table>

Research Paradigms and Study Propositions

As the researcher sought to understand the perceptions of the teacher, student and administrator participant groups included in this study, she used the constructivist-interpretivist paradigm as her lens (Ponterotto, 2005). The constructivist-interpretivist paradigm allowed the researcher to understand how the participants make sense of their reality. Moreover, since the researcher is a member of the study’s organization, the constructivist-interpretivist paradigm aligned with the sense-making process resulting from the dialog and interviews from the focus groups. Finally, to confront her biases, the researcher followed Yin (1981; 1997; 2009; 2012; 2013) and Stake’s (1995) lead, and developed propositions outlining her assumptions. Stake explains that,
although not always necessary in exploratory holistic or intrinsic case studies, propositions support the researcher’s direction, scope and data collection, providing a roadmap for the study (Miles, Huberman; Saldaña, 2015; Stake, 1995). According to Yin (2014), “Only if you are forced to state some propositions, will you move in the right direction” (chap. 2, sec. 4, para. 2). The propositions were as follows:

- Organizations that intentionally diffuse innovations, paying close attention to social systems, time, and communication channels, will have a greater likelihood of achieving their intended objectives.
- Teachers will purposefully integrate technology into content and pedagogy given sufficient communication, opportunities for collaboration, support, and time.
- Goal-oriented 1:1 solutions will foster increased innovation across educational organizations.
- Students will experience increased engagement, the acquisition of 21st century skills, and greater opportunities for deeper learning in 1:1 environments where teachers purposefully integrate technology.

Research Tradition

Sharon Merriam, Robert Stake, and Robert Yin, seminal researchers most closely linked to case study research, offer varied perspectives to the methodology. Merriam (1985), Yin (2012), and Stake (1994) agree that the literature presents perplexing attempts at defining case studies as a methodological approach. Merriam (1985) posits that these misconceptions occur because, unlike other methodologies, case studies follow qualitative, quantitative and mixed methods practices. Further, case studies support different purposes from topic exploration and examination to building theory. Merriam (1985) attempts to provide a clear definition of case study stating, “The case study
results in an intensive, holistic description and analysis of the phenomenon or social unit being studied” (p. 206). Analysis occurs through the examination of multiple sources of data (Merriam, 1998; Stake, 1994; Yin, 2012). As such, the case study approach aligned with the intention of this study, to understand the phenomenon of 1:1 at Glendale Public Schools.

Contemporary researchers like Baškarada (2014), Kyburz-Graber (2004), Lauckner, Paterson, and Krupa (2012), and Snyder (2012) move fluidly between the definitions and approaches of Merriam, Stake, and Yin. For example, Kyburz-Graber (2004), notes that case studies present statements of truth or findings through rich description pulled from multiple sources of data, in ways easily understood by the reader. However, although many argue that the case study is an inductive, constructivist approach (Merriam, 1985, 1998; Stake, 1994), contemporary studies following a quantitative approach align more closely with a deductive, positivist search for one reality (Lauckner et al., 2012). The researcher grounded this study within the approaches of Yin (2014) and Stake (1995), following a constructivist approach focused on the research questions and propositions previously noted. Adhering to this approach, the researcher developed a deep understanding of the phenomenon of 1:1 within its current context.

Overall, through case studies, researchers provide a deep description and holistic understanding not possible with quantitative measures (Baxter & Jack, 2008; Merriam, 1998; Stake, 1978, 1995; Yin, 2013). Stake (1978) explains, “because of the universality and importance of experiential understanding, and because of their compatibility with such understanding, case studies can be expected to have an epistemological advantage over other inquiry methods as a basis for naturalistic generalization” (p. 7). Significantly, where quantitative studies appropriately gauge frequency and likelihood, they fail to capture context and the lived experiences of the participants (Baškarada, 2014; Radley & Chamberlain, 2012). It is this deep insight through rich-description
that allows the case study methodology to provide greater access to contextual factors that influence the phenomenon (Snyder, 2012). As such, the case study approach allowed the researcher to use rich-description to provide relevant findings that teachers and educational leaders can consider in their practices when transitioning to 1:1 teaching and learning environments.

The researcher employed an instrumental case study approach. Instrumental case studies provide insight into a phenomenon and theory building beyond the particular case (Stake, 1994; 1995). As explained through the philosophical underpinnings and processes for data collection, data analysis, and presentation of findings, the case study methodology is best suited to studies that examine a specific phenomenon within the boundaries of its natural context. As such, researchers select the case that provides the best opportunity to understand the phenomenon they have targeted (Stake, 1994; 1995). In this study, the researcher selected Glendale Public Schools for the potential insights that she could glean for use by other educators and policy makers in the implementation of 1:1 programs.

Further, the researcher focused her study on embedded units within Glendale High School (Creswell, 2012). These embedded units included teachers within the four core content areas, building administrators, district administrators, underclassmen, and upperclassmen (see Table 3.1). In examining these embedded units of stakeholders, she developed an understanding of the perceptions of teachers, administrators, and students within and across these focus groups. Researchers use single case studies to investigate a critical case, an extreme case, a typical/representative case, a revelatory case, and a longitudinal case (Başkarada, 2014; Yin, 2009). The researcher used a single district as the site for this research study, focusing primarily on the high school. The high school was in the second year of its 1:1 solution, at the start of the data collection for this study. Data collection included interviews with teacher, administrator, and
student focus groups, as well as document review, allowing her to present valid, reliable, and generalizable findings in this Case Study (Creswell, 2012).

**Study Site and Participants**

The researcher is a central office administrator within site selected for this study, who was interested in understanding how teachers, administrators, and students perceive the district’s 1:1 program, related supports, and impact on teaching and learning. She selected Glendale Public Schools because of its long-range technology plan, and the focus on teaching and learning. The site is unique in its inclusion of teachers, students, and administrators in the goals and objectives to achieve deeper learning and 21st century skills.

Glendale Public Schools is a small, suburban district in New England with a student population of 3,400, and a teaching staff of 350. The district includes three kindergarten through grade three elementary schools, a grade four through five upper elementary, a grade six through eight middle school, and a comprehensive high school. The high school and the middle school transitioned to 1:1 technology integration. The high school serves approximately 1,100 students and houses 90 teachers. The researcher focused on the high school, as it was in the second year of 1:1 implementation.

The stakeholders included in the study were teachers, administrators, and students within the school and district identified for this study (see Table 3.1). As noted above, the researcher investigated her problem of practice across the embedded units of the core content areas (English, math, science, and social studies). She interviewed one focus group of four to five teachers per department, a student focus group representing each of the four grades at the high school, a focus group of building administrators, and a focus group of central office administrators using typical case selection methodology.
On average, a department includes eleven teachers. This researcher attempted to select a sample of teachers with three to five years, five to ten years, and more than ten years’ experience from these groups when possible. Thus, the focus groups included approximately one-third of the department members in each of the core areas, offering a broad range of perspectives on the structures, supports, and impact of 1:1. The inclusion of a representative sample of students and all the administrators provided rich-description of the phenomenon in this district.

As noted previously, the researcher selected Glendale Public Schools as the study site, to understand the teacher, student, and administrator perception of its long-range planning and rollout of 1:1. As part of the long-range plan, the district provided numerous opportunities for teacher development beginning in 2012. Professional learning occurred during the district’s seven professional development days, common planning time, lunch-and-learns, department meetings, and before and after school workshops. Over time, the professional learning evolved from voluntary workshops to teacher-led unconferences, where teachers share their expertise with their peers through informal, teacher-facilitated workshops. The focus on professional learning has been on the purposeful integration of technology into pedagogy and content, with the message that technology is a tool that may enhance but not replace good teaching. As such, the district has not established minimum or maximum requirements for the use of technology in classrooms, believing that integration should be appropriate to the task.

In 2013, all teachers received a device. Although the district began with a Bring Your Own Device program in 2013 (BYOD), the plan was to transition to 1:1 district-issued devices to ensure equity of access for all. In 2015, the district implemented this plan in grades nine through twelve. They expanded the 1:1 solution to grades six through eight in 2016, and will expand to grades four through five in 2017. The district does not intend to provide 1:1 devices in grades kindergarten
through three. However, the district will ensure a ratio of students to devices of 3:1 for in-school, instructional purposes.

**Recruitment and Access**

The researcher employed typical case selection to recruit participants for this study. The researcher requested teacher volunteers from each department and student volunteers from each grade. She also requested that all administrators at the building and district level participate in focus groups. As participation was voluntary, the researcher included the district superintendent in discussions about potential, allowable incentives. It is important to note, that although the researcher is an administrator in the district, she is not responsible for the evaluation of any participant.

To recruit the participants, she sent a letter to the Principal, Superintendent, parents of students under eighteen or students who are eighteen, and teachers. This letter outlined the purpose of the study, the scope of the study, and the potential risks and benefits of the study.

Once the researcher received approval from the Northeastern University Institutional Review Board (IRB), she recruited the participants. First, the researcher provided the teacher and administrator participants with the previously described letter through her Northeastern email and the students and parent letter through the support of the high school secretary. After potential participants expressed interest, the researcher provided them with an opportunity to meet with her to ask follow-up questions, before committing to focus group interviews. During the meetings, the researcher emphasized that participation was voluntary and that a participant could opt-out at any time during the study. The researcher also ensured the participants that she assigned a pseudonym to the data collected, and not mention them by name on any documents related to the study.

Finally, the researcher obtained a signature of informed consent provided by the university and
demographic information from the participant and parent/guardian before the research process began.

**Data Collection**

As part of this case study, the researcher conducted focus group interviews consisting of teachers, students, and administrators that lasted approximately 60 minutes each, recording the data for transcription and analysis (see Table 3.1). The district administrator group included the Superintendent, Director of Technology, Director of Finance, and Director of Pupil Personnel. The building administrator group included the Principal and two assistant principals. The researcher divided the teachers into four groups representing the core content areas (math, science, social studies and English). Each teacher group included four to five teachers from the same core content area. Also, the researcher divided the students into four groups of 9th, 10th, 11th and 12th grade students.

The researcher held most the focus groups during the student advisory period in a private, high school conference room. The researcher provided opportunities for a follow-up interview if needed for clarification of responses or at the request of a participant. The researcher interviewed each of the focus groups to capture the voices of the participants within their current context. The topic of the focus groups addressed the following overarching questions (Appendix A, B, C):

1. How does each group define the 1:1 innovation initiative?

2. How do they define and perceive the district’s intent to increase 21st century skills and deeper learning as a factor in this innovation?

3. How does each group perceive structures, supports and communication channels around the development, rollout, implementation and refinement of the 1:1 innovation?
4. How do they describe the time, use of resources, and supports provided by the district and school for the transition to and implementation of 1:1?

5. How do they describe the role of the organization’s social systems in the process?

6. How do they describe changes in teaching and learning as a result of the 1:1 technology integration initiative, if any?

7. What are the stories and artifacts that exemplify what has occurred as part of and the result of the innovation?

The researcher followed the interview protocol (Appendix A, B, C) that she developed as part of her Northeastern Program. Each participant answered demographic questions about themselves, such as their role in the organization and length of time within that role. Also, participants responded to open-ended questions designed to allow them an opportunity to explain their perceptions about the 1:1 program, supports, 21st century skills and deeper learning. She reminded participants of the purpose of the study, the voluntary nature of their participation, and risks and benefits of the study before beginning the interview and recording their responses. The researcher reminded all participants that she recorded them and that they could opt out of the study at any time. As required, the researcher submitted this protocol to the Northeastern University IRB before engaging in focus group interviews.

To develop a greater understanding of the context of the study, the researcher also conducted a document review. The review of documents provided additional evidence to confirm and validate the data from focus group interviews (Yin, 2014). She collected and analyzed documents and artifacts relevant to the 1:1 program, including policies, protocols, plans, surveys, website, lessons and student work. The researcher reminded participants that they could submit a lesson or student work not publicly available on a strictly voluntary basis. She also asked teachers
to remove personally identifiable information from student work samples, including first names, last names, or nicknames.

In an effort to reflect and analyze data throughout the study, the researcher developed extensive field notes. The field notes supported her in the eventual development of findings and study limitations.

**Data Storage**

The researcher stored data collected from the focus group transcripts and document reviews on her personal computer. She also uploaded and stored this data within MAXQDA software and MAXQDA App. Because this researcher stored data on her personal computer, with the use of a login password, she prohibited others from access. Finally, the researcher assigned pseudonyms to all participants to protect their identities.

The researcher used Rev.Com as the transcription service for some of the transcriptions and transcribed others herself. The researcher destroyed all audio tapes, once the transcription process was complete. She placed all signed, informed consent forms and documents in a locked file cabinet in her private, home office.

**Data Analysis**

To add structure to the analysis process, researchers typically conduct the data analysis in two cycles of coding (Charmaz, 2006; Saldaña, 2015). In the first cycle, the researcher employed In-Vivo coding to capture the words and language of the participants (Saldaña, 2016). For second cycle coding, the researcher employed pattern coding and memo writing to develop themes in relationship to each of the research questions (Saldaña, 2015; Yin, 2009). As the researcher coded and worked toward a thematic analysis of the data, she linked the qualitative data to propositions.
developed prior to the start of the study, to understand the reality of the phenomenon within its context (Stake, 2005; Yin, 2009).

The analysis and interpretation of data are critical to developing and presenting a meaningful set of findings linked to theory and research. To understand the phenomenon of 1:1 through teacher, student and administrator perceptions, the researcher analyzed the data from document reviews and focus group interviews. She analyzed this data based upon an initial-cycle and second-cycle coding system using MAXQDA software. In using the software, the researcher sorted the data for coding and analysis (Yin, 2009). Further, she used Excel sheets to examine the data across participant groups to understand the similarities and differences of experiences across the participant groups. In so doing, the researcher developed potential findings, conclusions, and generalizations (Yin, 2009). She then presented the data in the form of thick, descriptive narrative (Creswell, 2012).

**Trustworthiness**

As integral to this process, Merriam (1998), Stake (1994), and Yin (2012, 2013) agree that the researcher must collect and analyze data using methods that ensure validity, reliability, and generalizability. Stake (1994) indicates, “The case researcher needs to provide grounds for validating both the observation and the generalization” (p. 241). As such, the researcher engaged in the triangulation of data across sources to ensure validity, reliability, and generalizability of data and findings (Merriam, 1998, Stake, 1994; Yin, 2009, 2013). She triangulated the data from focus groups, document reviews, and field notes in support of her findings (Miles, Huberman, & Saldaña, 2014).

In addition, she informed the participants that they had the opportunity to engage in member checking to verify the accuracy of her transcriptions. Member checking allows the participant to
ensure and feel confident in the account of the phenomenon captured by the researcher. Importantly, she stated her assumptions and experiences through analytic memos and reflection to establish the transparency of the analysis process (Charmaz, 2006; Saldaña, 2015).

Finally, to ensure that the results are valid, she included participants that represent a broad range of organizational members. Before she began the interviews, the researcher informed the participants of the purpose of the study as well as reminded them of her positionality. She assured the participants of their anonymity and verified that their participation was in no way evaluative. The researcher also provided participants with assurances that she would use pseudonyms to protect their identity and that she would not share their personal data. As noted earlier, the researcher clarified her biases and outlined the research propositions before the start of the study.

**Protection of Human Subjects**

This researcher adhered to the Northeastern University IRB requirements in the protection of the participants engaged in the study. As noted above, before she began the research study, the researcher reminded the participants that their involvement in the study was voluntary and that they could opt out at any time. Also, she carefully reviewed, in writing and orally, the purpose, scope and potential risks and benefits of the study during the informed consent process and prior to the focus group interviews.

The researcher provided further protection of the students under eighteen of years of age through signed, informed assent from the student, as well as signed, informed consent from the parent/guardian. In addition, the researcher did not conduct any intervention on the student participants, but merely engaged in dialog to understand their experiences and perceptions. As such, “The intervention or procedure presents experiences to subjects that are reasonably
commensurate with those encountered in their actual or expected medical, dental, psychological, social, or educational situations” (National Institutes of Health, 2016, n.p.).

As the researcher does not serve in an evaluative role within the organization, the risks to the participants’ risks were minimal. Also, she provided further protection to participants with pseudonyms and confidential collection, storage, analysis and reporting of data.
Chapter IV: Research Findings

The purpose of this study was to identify and describe the key factors that may have led and contributed to the fostering of deeper learning and the acquisition of 21st century skills resulting from the implementation of 1:1 student Chromebooks, as perceived by administrators, teachers, and students at Glendale Public Schools located in the Northeast. The Diffusion of Innovation Theoretical Framework (Rogers, 1995) guided the study. Thus, the research questions for this study asked:

1. How has the district organized itself to support technology integration by teachers with the specific intent of fostering deeper learning and 21st century skills?
2. How do teachers, students, and administrators perceive the implementation of 1:1 and its impact on 21st century skill acquisition and deeper learning?

This chapter summarizes the demographics of the participants of the focus groups, examines the perceptions of administrators, students, and teachers at this site, reveals the data collected, and outlines the themes that emerged.

Summary of Study Site, Participants, Focus Groups and Data Collected

The participants for this study included central office administrators, building administrators, students in grades nine through twelve, and core content teachers from one suburban district and its high school in the Northeast. The district is a high-socioeconomic, high-performance district with approximately 3,500 students across six buildings. The high school includes 1,100 students in grades nine through twelve. The high school was in its second year of implementing 1:1 technology at the time of the study. The participants of the focus groups were selected based on their experience with the 1:1 innovation at the district and school level. An administrative assistant supported the scheduling of focus groups based on the availability and
convenience of the administrators, students, and teachers. Also, she provided the participants with letters of introduction and Internal Review Board consent documents.

The focus groups were invited to volunteer as they represented the population of the school and the district. Each central office administrator had been with the district for more than ten years and previously served in non-administrative roles. Each building administrator at the high school served in their roles for a minimum of five-years. As the school district sees little student mobility, all the students had been in the district since first grade, with the majority attending since kindergarten. Although invited, fewer female students opted to volunteer in grades ten through twelve. Also, several students in grade eleven were absent on the day of the focus groups. As the retention rate for teachers in the district is 98%, all teachers had been in the district for an average of ten years. Table 4.1 outlines the administrators’ gender and role. Table 4.2 includes an overview of the students, their grade, and their gender. Finally, Table 4.3 provides a snapshot of the core teachers, their gender, and departments.

Table 4.1

*Administrator, Gender, Department*

<table>
<thead>
<tr>
<th>Administrator</th>
<th>Gender</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert</td>
<td>Male</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Peter</td>
<td>Male</td>
<td>Finance</td>
</tr>
<tr>
<td>James</td>
<td>Male</td>
<td>Technology</td>
</tr>
<tr>
<td>Teresa</td>
<td>Female</td>
<td>Pupil Personnel</td>
</tr>
<tr>
<td>Thomas</td>
<td>Male</td>
<td>Building Admin</td>
</tr>
<tr>
<td>Frank</td>
<td>Male</td>
<td>Building Admin</td>
</tr>
<tr>
<td>Stephanie</td>
<td>Female</td>
<td>Building Admin</td>
</tr>
</tbody>
</table>
Table 4.2

*Students, Gender, Grade*

<table>
<thead>
<tr>
<th>Students</th>
<th>Gender</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susan</td>
<td>Female</td>
<td>Grade 9</td>
</tr>
<tr>
<td>Beth</td>
<td>Female</td>
<td>Grade 9</td>
</tr>
<tr>
<td>Sara</td>
<td>Female</td>
<td>Grade 9</td>
</tr>
<tr>
<td>Tara</td>
<td>Female</td>
<td>Grade 9</td>
</tr>
<tr>
<td>Seth</td>
<td>Male</td>
<td>Grade 9</td>
</tr>
<tr>
<td>Tim</td>
<td>Male</td>
<td>Grade 9</td>
</tr>
<tr>
<td>Steven</td>
<td>Male</td>
<td>Grade 10</td>
</tr>
<tr>
<td>Max</td>
<td>Male</td>
<td>Grade 10</td>
</tr>
<tr>
<td>Rob</td>
<td>Male</td>
<td>Grade 10</td>
</tr>
<tr>
<td>Ted</td>
<td>Male</td>
<td>Grade 10</td>
</tr>
<tr>
<td>Henry</td>
<td>Male</td>
<td>Grade 10</td>
</tr>
<tr>
<td>Kyle</td>
<td>Male</td>
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</tr>
<tr>
<td>Vance</td>
<td>Male</td>
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</tr>
<tr>
<td>Luke</td>
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</tr>
<tr>
<td>Calvin</td>
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</tr>
<tr>
<td>Caleb</td>
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<td>Grade 12</td>
</tr>
<tr>
<td>Nick</td>
<td>Male</td>
<td>Grade 12</td>
</tr>
<tr>
<td>Sam</td>
<td>Male</td>
<td>Grade 12</td>
</tr>
</tbody>
</table>
The researcher held a series of fourteen focus groups. The groups included one central office group, one building administrator group, four student groups, which each met once, as well as four teacher focus groups which each met twice. Participants in the focus groups were asked a series of questions related to the research questions outlined above. In addition, during their second meeting, the teachers brought samples of lesson plans and student work that they believed

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Gender</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maria</td>
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<td>Science</td>
</tr>
<tr>
<td>Isabella</td>
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<td>Science</td>
</tr>
<tr>
<td>Marybeth</td>
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<td>Science</td>
</tr>
<tr>
<td>Stacy</td>
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<td>Science</td>
</tr>
<tr>
<td>Cooper</td>
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<td>Science</td>
</tr>
<tr>
<td>Elliot</td>
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<td>Math</td>
</tr>
<tr>
<td>Jane</td>
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<td>Math</td>
</tr>
<tr>
<td>Charles</td>
<td>Male</td>
<td>Math</td>
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represented technology integration, 21st century skills, and deeper learning competencies. At these focus groups, the teachers explained and shared the samples, and the researcher asked questions related to the document share. After the focus groups, the researcher used REV.com to transcribe the discussion. The researcher shared the transcriptions with each participant and provided them with an opportunity to correct any discrepancies. The researcher entered the transcripts into MaxQDA software to analyze the data for emerging themes and patterns, using a multiple-step coding process. The researcher first used In vivo coding, then descriptive coding, followed by categorization and theme development.

In addition to collecting data from the focus groups, the researcher also reviewed school and district documents relative to the 1:1 program and teaching and learning. These documents included the high school program of studies, student handbooks, website content, lesson plans, and student work. The researcher used these supporting documents to support the triangulation of the data along with the focus group interview data.

In the following section, the researcher presents the overarching themes resulting from the focus group interviews and document reviews. The researcher used data from each focus group to understand the research questions presented.

Research Question 1: How has the district organized itself to support technology integration by teachers with the specific intent of fostering deeper learning and 21st century skills?

During these sessions four important themes emerged relative to district organization and supports for 1:1 from the perspectives of administrators, students, and teachers. The themes that emerged are presented in Table 4. Although the themes intersect all three groups, the perceptions regarding success of the district’s organizational supports often vary.
Strategic planning and reliable systems were essential for Glendale Public Schools’ 1:1 initiative to drive 21st century skills and deeper learning. A reliable infrastructure and compatible hardware and software were necessary to support technology integration, 21st century skills, and deeper learning competencies at Glendale Public Schools. Communication around roll-out, implementation and teaching and learning expectations were critical to Glendale Public Schools’ transition to 21st century educational environments. On-going support for technology integration into instruction was critical to developing 21st century skills and deeper learning at Glendale High School.

Strategic planning and reliable systems were essential for Glendale Public Schools’ 1:1 initiative to drive 21st century skills and deeper learning at Glendale Public Schools. Per the administrators involved in the focus group discussions, the decision to transition to 1:1 was well-thought out and envisioned years before implementation. The administrators explained that the district developed a strategic technology plan that encompassed the infrastructure, hardware, software, and educational objectives outlined by a technology steering committee consisting of district leadership, school leadership, teachers, students, parents and community members. The plan incorporated the International Society for Technology Education (ISTE) standards as well as the levers for success outlined by National Educational Technology Plan (2010). During the first year of the plan, the district improved the infrastructure and bandwidth of the six schools. In years two and three, they provided teachers with 1:1 Fujitsu laptops, professional development, and increased the number of Chromebook devices and iPads in each school. In year four, the district provided students in grades nine through twelve their 1:1 Chromebook devices. Now, in year five, they issued devices to students in grades six through eight. Professional development continued
throughout the five years, and into the present year. Currently, the administrators revealed that the district is preparing to develop the next iteration of the technology strategic plan.

During the focus groups, the administrators also agreed that the final decision to adopt a 1:1 program was to prepare students with 21st century skills and deeper learning (DL) competencies requisite for success beyond high school. Although the administrators noted that part of the decision to increase student access to devices was to prepare for state testing requirements, they said that the driving reason to transition to 1:1 was to support teaching and learning. As such, the administrators regularly referenced equity, DL, 21st century skills, and academic achievement as the primary goals. For example, one administrator shared, “The innovation initiative, it's an initiative to help develop new ideas for the classroom that might be outside the scope of what we would usually think of for education.” In sum, the administrators suggested that the decision to develop a strategic technology plan centered on the provision of 1:1 devices to ensure all students had equitable access to high-quality resources to increase 21st century skills and DL.

The teachers and students also referenced Glendale’s plan to prepare students for the expectations of the modern world. To create an appropriate program, several students reported that the district conducted research supporting the decision to increase technology integration and 21st century skills through the provision of 1:1 student devices. As one student expressed,

The district looked at studies and research that indicated that students who have technology, a device, for school purposes perform better. I think it all goes back to the district’s mission statement that we empower students to excel. It would be a disservice to the students to not integrate technology into the curriculum.

In fact, all students noted that Glendale provided them with 1:1 technology because it would prepare them for a “global world” and post-secondary education.
The administrators agreed that they had a laser-like focus on ensuring that student outcomes continued to align to the mission of the district. As such, the administrators indicated that, in every decision they made, they asked themselves if they were meeting their mission, to empower students to excel. Although the administrators emphasized their focus on the mission, they continued to stress the need to determine how best to measure outcomes related to 21st century skills and deeper learning (DL). Next, Glendale administrators suggested that the strategic implementation plan is, and should be, in a constant state of iteration. Although they continuously revisit the plan, the administrators concluded that an immediate need to evaluate success criteria exists. As one administrator expressed, “I think as we move forward it's getting back to that question of how do we measure its success.” As such, the administrators agreed that although the plan has target dates, it lacks measurable objectives from a systems perspective. They stressed that their keys priorities for the next strategic plan include developing goals and tools to measure them.

All administrators participating in the study revealed that the Glendale Strategic Plan directly impacted the schools. As one building principal explained, “If you try to contain it to one school, it's not going to work. It really has to start from central administration, but have a systemic approach. I think that's where we benefited as a district.” However, because of the primary role of the central office, the three building administrators also indicated that they had many questions regarding the future. Some of the questions included, “As technology increases, what is the plan to address that; How are we going to sustain this; and What is this going to look like moving forward?” The teacher participants referenced similar questions regarding the long-range plan.

The building administrators and teachers stressed the importance of their voice in budget, planning and implementation decisions. In fact, the building principals confirmed as their level of understanding and involvement increased, so did their ability to support teachers. Thus, the
administrators and the teachers emphasized the importance of iterative strategic planning and stakeholder participation in implementing the Glendale 1:1 program that focused on teaching and learning.

**A reliable infrastructure and compatible hardware and software were necessary to support technology integration, 21st century skills, and deeper learning competencies at Glendale Public Schools.** First and foremost, all administrators stressed that funding is directly related to the strategic plan. They explained that without an annual plan to fund the 1:1 initiative, the district would be unable to implement and sustain the initiative’s infrastructure, hardware, and software requirements. They clarified that funding is a complex issue and requires clear communication and partnership with the town and school committee. Although the administrators emphasized that they sought grant funding, they also needed to ensure a stable district-level capital budget. In the end, the district administrators expressed that they decided to purchase the devices to avoid the extra expense of interest charges associated with leases. The administrators perceived that the option to purchase rather than lease supported the district’s ability to expand and sustain the technology plan continuously. Glendale administrator participants specified that if teachers and parents did not think that the district could maintain the program through a reliable stream of funding, technology integration for 21st century teaching and learning would not occur. Thus, the administrators contended that a reliable and capable infrastructure was key in ensuring that Glendale’s 1:1 initiative was successful.

Although the initial funding for infrastructure and bandwidth came from the Wireless Classroom Grant, the district has since built it into their capital budget. The infrastructure allowed Glendale to move forward with the 1:1 initiative. The district administrators reported pride because “the district is probably almost unmatched by anyone else in the state because of all the
pre-work we did.” As previously noted, the administrators emphasized that reliable infrastructure allows teachers and students at Glendale to access high-quality resources and 21st century learning opportunities. Moreover, the students and teachers also emphasized that Glendale’s robust infrastructure for technology integration fostered 21st century skills and DL competencies.

All students, most teachers, and most departments stressed that Glendale provided a reliable infrastructure, necessary to promote 21st century skills and DL. The teachers explained that when the infrastructure fails, they are forced to rely on more traditional instructional strategies and materials. They stated the failure of the Internet on a few occasions caused disruption to teaching and learning. For example, during a recent advisory the Internet crashed when the entire school tried to access it at the same time. Most teachers and all students agreed that they felt confident that the district addressed issues as they became aware, and “that it's the exception rather than the rule when it happens.” Additionally, one teacher noted, “I think every year we've upgraded our system to become stronger and stronger, and I think we'll just continue to do that.” Finally, Glendale teachers participating in the study stressed that without a reliable infrastructure, they would hesitate to shift their instructional strategies to emphasize 21st century skills and DL.

The science department expressed greater concerns about the infrastructure than the teachers from other departments. The science teachers shared more significant concerns about the disruptions that occurred when the Internet failed. In addition, the science department articulated concerns related to the time it takes the technology department to repair issues with the infrastructure. Still, most departments stressed that because Glendale provides a reliable infrastructure, they integrate technology and 21st century skills into teaching and learning daily.

Beyond the bandwidth and access to Internet, the teachers and students also emphasized the importance of the provision of reliable devices used by teachers and students. Most teachers agreed
that the 1:1 hardware meets their instructional needs to a greater degree than the BYOD and Chromebook cart solutions, stating teachers were “almost in competition with each other” for the resources. Also, students reported that under the BYOD program they did not always have access to a device when they needed it, and several students noted struggling to find access at home. All the teachers and students contended that the BYOD and laptops on carts caused stressful situations.

Thus, the Glendale teacher, administrator, and student participants agreed that a reliable device is as important as a dependable infrastructure. Although the students suggested that the district’s Chromebooks decision supports their learning needs, the teachers expressed concerns about the potential of a switch from touch-screen Windows devices to Chromebooks. The teachers indicated that they have not heard this directly from the district. However, if the district decides that teachers will receive Chromebooks as the district replaces the older Windows devices, they are unsure that the devices will be able to meet their instructional needs. As such, the teachers expressed a desire to be involved in future decisions relative to hardware and software to meet their instructional needs to transform instruction with technology.

The administrators argued that in addition to the infrastructure and the devices, the learning platform is essential in supporting the goals of 21st century teaching and learning. First, the district administrators explained that the platform decision allows for software management efficiencies in terms of time and money. They agreed, however, that more important than cost, the platform needed to meet the goals of teaching and learning. The Glendale building and district administrators believed that the decision to adopt the Google Classroom Platform positively impacted teaching, and has been integral in shifting instruction to include more 21st century skills. Overall, the administrators concluded that overall the Google Platform is working for teaching and learning, and continuous evaluations of the effectiveness of the platform will need to occur over
Moreover, they emphasized that hardware and software available should be selected to achieve the goals and outcomes established by the Glendale Strategic Plan.

Collectively, the teachers and the students expressed that Glendale’s provision of the Google Platform and Google Classroom have allowed for 21st century teaching and learning. As one teacher emphasized, “I think Google Classroom profoundly impacted how we teach; it completely revolutionized collaborative learning and how we can expect the learning environment to go beyond the classroom.” Although several teachers acknowledged that there are areas that Chromebook could improve; all agreed that district’s decision to adopt Google Classroom supports 21st century learning and DL.

The Glendale teacher participants also acknowledged that they require ongoing support from the district regarding software that is necessary for teaching and learning, but not compatible with Chrome. For example, the math and science department continue to struggle with the Chromebook’s lack of ability to allow for easy typing of mathematical formulas and ability to run specialized programs, such as Smart Notebook, Flash-based simulations, and probe software. However, most teachers expressed hope that as more schools use Chromebooks, the software compatibility will improve. As such, the teachers emphatically stressed that they need to be involved in decisions about software and hardware to ensure that the technology supports the learning objectives and fosters DL across all content areas.

The Glendale administrator participants also contended that the infrastructure is more than the initial roll-out to the teachers and the students, and requires a significant amount of ongoing support. From an operational standpoint, the students and the administrators acknowledged that the Chromebooks decreased technology support issues. Although students lamented the inability to download programs, they also recognized that it prevented viruses and malfunctions. In fact, the
students agreed that the school and district offered sufficient hardware and software support to minimize disruptions to their learning.

The decision to transition to 1:1 significantly impacted the Instructional Technology (IT) Department, who “over the last two years implemented nineteen hundred more machines.” The administrators, teachers, and students discussed creative ways in which the district extended this support, such as the implementation of the Student Technology Assistance Team (STAT). The students who make up the STAT team support the hardware and software needs on the Chromebooks at the middle school and the high school. They maintain the inventory, repair devices, and support the use of the technology, alleviating the strain on the IT department, “while increasing their real-world skills.” The use of the STAT team allowed the IT department to have more time to focus on the walls infrastructure, necessary to ensure reliable access for teaching and learning. One student initiated STAT with the approval of the administrators, to support the district’s objectives. Students on the team developed protocols and systems of support for the Chromebooks and Google Platform. The teachers and administrators also indicated that STAT is an integral district resource in supporting the 1:1 hardware and software infrastructure. Nearly every student and teacher on the focus groups pointed to the STAT team as the reason the hardware and software infrastructure supported learning in the school.

Communication regarding roll-out, implementation and teaching and learning expectations were critical to Glendale Public Schools’ transition to 21st century educational environments. Although the administrator participants all agreed that communication regarding expectations is as important as building teacher trust in the infrastructure and related technologies, they highlighted communication with teachers as an area of ongoing need. The administrators contended that beyond setting expectations for email and grade books, Glendale did not
communicate top-down expectations for the use of the devices or technology in the classroom. One administrator suggested that the district lacked some communication around the strategic vision, and expressed needs for improvement,

I think there's snippets that come out here and there, but there's no real campaign to show what the successes were in implementation from a public viewpoint. So, like with anything that we do, it's all a theory of improvement. It's how do we celebrate our successes, and how to we share our teaching and learning in a way that supports the investments that we make and secures future investments that we need to make.

For example, the administrators indicated a need to establish clear protocols and expectations around teacher-student communication, as although immediate communication is possible twenty-four hours a day, it may not be reasonable. The administrators relayed that they are improving these systems of communication about expectations community-wide.

Most students reported that district communication with them around the expectations of 1:1 was sufficient. The students stated that they understood the progression to 1:1 from carts and BYOD. In fact, all the students indicated that they thought the district’s decision to go 1:1 was an “obvious one.” Most students also expressed feeling prepared to move to the Chromebooks because they had been using the carts of Chromebooks the school offered the year before, “The only real difference is that we could keep them and take them home. So, it wasn't that complicated for the new system.” In fact, all the students explained that students were given their devices as part of orientation, and kept their devices for the remainder of the summer, allowing them to acclimate to the devices. Many students also articulated that 21st century teaching and learning has “been part of our education, this year, since the very beginning.” Although the students emphasized that the Chromebooks are simple for student and teacher use, access, and collaboration; the freshmen, noted
that they needed additional time to transition. Conversely, the sophomores, juniors, and seniors all contended that they did not have any difficulty with the transition, as the district provided them with regular access, before 1:1, especially for collaborating and accessing their learning resources. As such, most students agreed with the decision to transition to 1:1 and level of communication, as they revealed it provided them with access to resources and supported the development of 21st century skills.

Overall, the students indicated that the received adequate communications; however, they emphasized that some of their parents reported concerns. Several students suggested that several parents worried that their child would lose their device. As such, they offered that the district needs to engage in more communication with parents around the different supports the district put in place, such as the option to check-in/check-out a device, rather than taking it home. A few students also shared their parents’ stress about student access to unsafe websites, social media, and too much screen time. Again, the students posited that although the school provided parents communication around these concerns; the school would alleviate parental concerns by offering more communication and individualized support. Finally, they reported that some of their parents believed that students would be behind a screen all day. The students all stated that teachers who integrate technology strategically, incorporate the 1:1 devices to reach 21st century skills and DL. Thus, they recommended that the school communicate clear examples of how students use the technology in a typical day.

The Glendale administrators also agreed that critical to the implementation of 1:1 was more communication with parents; however, they reported more success in this area than the students revealed. First and foremost, the administrators stressed the need to communicate the educational goals of 1:1 and technology integration. They suggested, and students and teachers agreed, that
home-school communication around purpose and expectations will decrease parents’
misconceptions that, “that kids are just going to be behind a computer all day, and there wasn't
going to be as much of the teaching going on.” The administrators indicated that they have begun to
use tools such as social media to demonstrate the shifts in teaching and learning, highlighting the
DL that they observe in the classroom.

Next, the Glendale administrators emphasized the importance of communicating and
sharing resources with parents on digital literacy and safety. In fact, Glendale required that all
teachers and schools implement the Common-Sense Media curriculum to support and educate
parents, students, and teachers on cyber safety. Also, the district hosted forums led by the Attorney
General’s office and Media Smarts to ensure that members of the school community understood
what it meant to be a good and safe “digital citizen.” In addition, the administrators revealed that
they conducted numerous parent forums to ensure clear communication about the purpose and
expectations of 1:1.

The district-level administrators reflected that they might have benefited from holding
similar discussions with teachers and students. Instead, they noted that they relied primarily on
professional development sessions as “a key part of communicating how we were going forward.”
All administrators agreed that in retrospect, they wished they had included more teacher and student
voice in the process through communication, and indicated that was their plan moving forward.

The students and teachers on the focus groups agreed with the administrators that teachers
required more two-way communication regarding the transition to 1:1 to foster 21st century skills
and DL. The students primarily noted that because the Glendale did not provide common
expectations for all teachers regarding the integration of technology into the curriculum and
instruction, the student experiences were very different across teachers. The students stated that the
different expectations set by teachers provided them with significant challenges that could have been off-set by clear communication from the district.

The teachers revealed that a major component of teacher involvement in decision-making involves clear communication and expectations about technology use. For the most part, teachers felt prepared for the transition to a 1:1 teaching and learning environment. They indicated that the teacher laptop program and BYOD program “was a nice transition for us…teachers got their feet wet a little bit with the idea of having the students have access to a device in the classroom.”

Glendale teacher participants suggested that having had an opportunity to transition, they are now expanding their use of the technology beyond “word processing, or collaborative writing, or researching.” However, they indicated that the district did not set a minimal level of technology integration as an expectation.

All Glendale teacher participants agreed that communication and clear expectations are important to ensure that technology is integrated to meet 21st century skills and DL competencies. However, the teachers reported mixed feelings about the level of communication and clarity of expectations from the district about technology integration. For the most part, teachers in the English Department (ELA) perceived that communication was sufficient and ongoing. As one ELA teacher shared, “I do feel that people have listened to what we've asked for… and those opportunities have definitely been provided based on feedback that the administration has received from teacher surveys.” Whereas, teachers in the other departments conveyed the need for greater communication and clarity around expectations. In fact, some of the teachers indicated that the district anticipated that teachers would independently realize the justification and expectations for use. These teachers shared that they would have preferred direct communication regarding expectations.
Further, some teachers also emphasized the need for more ongoing communication from building level administrators. As one math teacher noted, “I think there needs to be some sort of validation from our bosses that what we’re doing is unbelievable. I don't always believe in top down; I believe that you have to educate the teachers and back it up with research and evidence.”

Regardless of department, Glendale teacher participants expressed mixed feelings on top-down expectations.

Several teachers articulated that they preferred the absence of top-down expectations. As one teacher expressed, “I think one of the strengths of our implementation was there wasn't some directive.” Similarly, some teachers preferred to be given the opportunity to develop expectations as teams of teachers. For example, one teacher shared,

I'm reading the book right now, I sound like a nerd, Collaborative Leadership by Peter Glick … He makes some really good points about faculty and collaborative leadership. We have a lot of leaders and we don't need our principal to say I want you to do something and then we're going to think it's compliance and then it goes to the union that's not what it's about. It's about making your class better. I think it has to come from the teams.

As such, many of the teachers believed that Glendale gave them the freedom to make decisions about the use of the devices for teaching and learning.

Other teachers stressed that they needed more support, direction, and communication. They reported that the transition has been stressful for them. These teachers shared that, although they understood the on-going professional development to be the system of communication, the message was not direct. Thus, teachers relayed different opinions on the systems of communication and expectation employed by the district as it organized itself to support 21st century teaching and
learning. Overall, the Glendale teacher participants shared a desire to be a part of the decision making and ongoing conversation relative to 21st century teaching and learning.

The teachers also had mixed feelings on their ability to be involved in the iterative process of defining the 1:1 program and its purpose. Many teachers reported that administrators hear their voices and that the district affords them professional lee-way. For example, one teacher stated,

We all feel like we have the freedom to experiment, to try. I know that's not the case in a lot of places. That's really powerful, but I think because it's not talked about, I don't think it needs to be a directive, but I think it needs to be talked about.

Even the teachers who enjoyed the opportunity to experiment in their classrooms recommended greater communication, not to set top-down directives, but to help guide decisions. As such, teachers suggested that the district provide opportunities for teacher focus groups to encourage more teacher voice and leadership in the shift toward 21st century teaching and DL.

**On-going support for technology integration into instruction was critical to developing 21st century skills and deeper learning at Glendale Public Schools.** The Glendale administrator, teacher and student participants unequivocally agreed that teachers require multiple facets of support to integrate technology for student acquisition of 21st century skills and deeper learning (DL). Supports currently in place include professional development (PD), job-embedded coaching, peer-to-peer collaboration, and the Student Assistance Support Team (STAT).

The administrators conveyed the need for support to center around PD in support of 21st century instructional strategies and DL competencies. The administrators agreed that to be successful in developing 21st century skills and DL, that the transition to 1:1 must occur thoughtfully over time to adequately support teachers and students. The building administrators suggested that the real transition began when the teachers first received their devices. They
explained that before the students received their devices, the teachers had a year of PD and opportunity to build their comfort and skills without the pressure of a 1:1 environment. The administrators revealed that they began to note changes in instruction, toward 21st century skills, as teachers became more comfortable with the devices. However, they also agreed that teachers appeared to find it difficult to work in the BYOD environment, where they were unable to depend on student access to technology. Thus, the administrators suggested that PD did not support more complex shifts in instruction, until the transition from BYOD to 1:1.

Where teachers expressed differing opinions on many of the organizational supports provided by the district, they overwhelmingly celebrated the district support for STAT. They shared that STAT provided them with effective systems of support for teaching and learning. Also, teachers felt that the STAT team is responsive to their immediate needs. In fact, some teachers argued that the STAT team was an even greater support than PD. As one teacher offered, “for the teachers having an unconference is great, but then having the STAT team to help work with the students and help the teachers, that's been huge. That's been crucial in terms of the success of implementing 1:1.” Moreover, the teachers reported STAT reinforced their efforts at “project-based learning.” The teachers collectively noted that STAT enhanced their ability to transition to 21st century teaching and DL. The administrators and the students agreed that, although an unintended benefit, STAT supported the transition to 21st century teaching and learning.

Although several Glendale teacher participants stated that STAT was more helpful than PD, they also agreed that the district focused on and provided ongoing PD to support 21st century skills and DL competencies. The administrators and teachers discussed a new format of PD offered by the district, unconferences, where teachers could learn through peer-to-peer learning workshops. In this model, teachers offered collaborative professional learning workshops for their peers. The
administrators suggested that this peer model supported instructional shifts. Also, the administrators contended that teachers benefitted from the safe and collaborative nature of this design. As one teacher explained, “At first it sounds like basic, but then we all have different things that we found through the learning process, and just having the opportunity to share those because everyone is so busy. The unconference gives that opportunity.” Overall, the Glendale teacher participants reported that the unconferences fostered collaborative, just-in-time learning.

Glendale administrators emphasized that high-quality, ongoing, collaborative PD, focusing on 21st century instructional strategies, is critical to the transition to 1:1. The administrators suggested that they wanted to ensure that teachers maintained their research-based instructional practices with the transition to 1:1 and technology integration. They also agreed that teachers required support to adopt strategies that targeted 21st century skill acquisition and DL, “Not losing the good teaching, but making sure that there's continued professional development.” Although the administrators intended the unconference to meet the goal of supporting effective instructional practices, some teachers expressed a need to move on to other models of PD that allow them to go deeper. They posited, “we're maybe looking for that next level- That isn't available to us from people within the district.” These teachers stated that the unconferences focused too much on how to use technology, rather than what transformation looks like in the classroom. In fact, they recommended that future PD pushes them to transform their classrooms.

In addition to the unconference model, the teachers reported that Glendale offers a wide-array of professional learning opportunities. Teachers suggested, “Even outside of just what we're given in our schools, there are a lot of opportunities.” Moving forward, most teachers expressed a desire to visit classrooms with successful implementation of technology integration, 21st century skills, and DL competencies. In fact, teachers agreed that this was one of the problems with the
unconference. For example, one teacher offered, “I think those unconferences were hard because you never saw it in action.” These teachers expressed that the school and district encourage and supports teachers to visit each other’s classrooms; however, they would also like to visit classrooms beyond Glendale.

Although the district provides multiple opportunities and avenues for PD, the teachers and students agreed that teachers need more and different PD to foster 21st century skills and DL. The students repeatedly suggested that the school should provide teachers with additional PD, to more seamlessly integrate technology integration across their classes. Although students noted a need for more teacher development, they also argued that most teachers are willing to learn. As one student shared, “I think certain teachers need to be brought up-to-speed. I think certain teachers just aren't there yet with being able to do it. I think they're willing.” Thus, students believe that ongoing teacher PD is necessary to support the integration of technology into teaching and learning at Glendale Public Schools.

The Glendale teacher participants also emphasized a need for job-embedded instructional coaching. They indicated that the district had provided a coach in the first year of 1:1, and lamented the loss of that support because, “now I'm ready to try to take it to the next level, and that support isn't there anymore.” The administrators also pointed to the need for embedded instructional coaching. Thus, the administrators shared that they needed to revisit the decision to remove the technology coach, as job-embedded coaching is a successful tool in the transition to 21st century teaching and learning.

Most teacher participants outside of the math department indicated that they did not find the coach helpful, as the coach’s content area was outside of their discipline. In place of the technology coach, these teachers expressed their preference for increased content-specific support and more
departmental common planning time (CPT). One teacher said, “In the absence of the Fuse Fellow [technology coach] now, I really see my most important resource as teachers that are better than me at it or teachers that have tried different things. We just don't have enough common planning time to really play with that.” As such, although the teachers agreed that PD was essential to foster 21st century skills and DL, they stressed coaching and time for collaboration are more powerful.

Every teacher participant emphasized the need to collaborate with their colleagues on a regular basis to improve practice around 21st century skills and DL. The teachers explained that they currently collaborate at bimonthly CPT, department meetings, and seven PD days. However, the teachers suggested the need for additional CPT, especially for interdisciplinary planning and DL. Many teachers described collaboration as evolving and improving practice. For example, one teacher explained the current Professional Learning Community (PLC) work of the District,

So underneath that is we have this lead cohort of teachers throughout our district, probably made up of ten teachers and administrators where we are incorporating in different types of effective tools in the classroom. It's all based on Hattie’s work, *Visible Learning*, and all his research that he has done. So, our district has taken the initiative to actually walk through other schools and hold teachers accountable, if they are actually using the research in their classroom, trying the tools, and we've found that has changed students learning and their achievement levels.

In keeping with the theme of PLC, the teachers argued that technology integration, 21st century skills, and DL need to be incorporated into the Glendale walk-throughs and ensuing efforts at continuous improvement.

All Glendale administrators agreed with the teachers that collaboration and peer-to-peer sharing of practice was a critical factor in the transition to 1:1. As such, the administrators
explained that they are evaluating new schedules to allow for increased CPT time, both within and across departments. The administrators also similarly emphasized the district operates under the tenets of a professional learning community (PLC). Glendale provides teachers ongoing opportunities to collaborate and share their learning and practices during district unconferences, regular department meetings, and common planning time (CPT). Since the inception of a teacher leadership program, the administrators conveyed that teachers collaborate and invite one another into their classrooms to share best practices. They stressed that teacher collaboration is an important part of the culture of the district. Still, the administrators also agreed that, at times, Glendale High School teachers need support beyond the collaborative teams.

The teacher participants acknowledged that change is difficult. They reported that the most valuable support the district can give them as they transition is time. Several teachers noted that because they teach in a high-performing district, many teachers do not have a sense of urgency to change their practice. They suggested that in giving teachers time to collaborate with one another through unconferences, classroom walks, and CPT, the district allows the conversation around change to occur organically. As one teacher offered, “To give people time, to keep it on the radar, that's the thing. To keep getting people to push to think about what they're doing in different ways, that needs to continue.” Without exception, teachers reported the need for collaborative time to improve practices to foster 21st century teaching and DL at Glendale Public Schools.

Finally, to meet the request from teachers for even greater opportunities for differentiated PD, the administrators explained that they now use a badging system as an added support. They articulated that the system provides teachers with expert, micro-credentials based on their ability to apply what they have learned and to teach others. The contended that using badges, teachers will not only be able to build their expertise but will also be able to determine which of their peers can
support their learning as experts. As such, they expressed hope that this addition to the system of PD, PLC, and collaborative time will further support Glendale teachers’ ability to integrate technology into instruction to foster 21st century skills acquisition and DL.

Research Question Two: How do administrators, teachers, and students perceive the implementation of 1:1 and its impact on 21st century skills and deeper learning?

During the focus group discussions, administrators, teachers, and students acknowledged several district-wide impacts on teaching and learning. Table 5 outlines the themes that emerged during the focus group discussions.

Table 4.5

Themes from Administrators, Teachers and Students in Relationship to the Second Research Question

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Equity of 1:1 devices and access to resources have positive educational impacts on Glendale student learning. Although the administrators, students, and teachers noted many impacts on 21st century skills and deeper learning (DL), they all emphasized the 1:1 program has resulted in an ability to increase the achievement levels of all students through universal access to resources, differentiation strategies, and interventions. As one administrator shared, “we're creating a level playing field for our students, and we're not leaving anybody behind because they don't
necessarily have the outside school resources.” In fact, although the district is primarily high socioeconomic, the students stated that before 1:1 many students were unable to bring a quality device to school daily. Moreover, the administrators, students, and teachers contended that if students did have access to a device, many struggled to share it at home with their parents and siblings.

The administrators reported that their previous Bring Your Own Device (BYOD) solution created significant inequities for students and explained that they no longer see these imbalances in the classroom. Additionally, building and district administrators emphasized the provision of Chromebooks for all students removed economic advantages, while giving students the tools and resources they needed to access materials and develop 21st century skills. Thus, in their opinion, the 1:1 program equitably allows all students to engage in their academic work, regardless of income. One student, who struggled in the past, shared his story,

I'm a in lower middle-class family, so I don't have my own laptop. The computer I have at my house is ten-years old. It's running Windows Vista. That's really old. It's not compatible with Chrome anymore. It's not compatible with a lot of stuff. When my mom heard that the district was providing all students with a Chromebook, and I would have my own access, it was definitely a way for me to have that opportunity to have a personalized area where I could work, and…it took away that issue of, ‘Well, maybe I won't be able to do my assignment, if that program doesn't work anymore.’

Overall, the students, teachers, and administrators, expressed that equity of devices removed barriers to students performing as well as their peers at Glendale, who may have access to more resources at home. Besides, the students noted that the 1:1 program provides Glendale students without personal devices the same opportunities to practice their 21st century skills as their peers.
Before the roll-out of 1:1, Glendale provided students with access to technology through a Bring Your Own Device (BYOD) option, as well as Chromebooks carts. The teachers agreed that these solutions did not provide equitable access, nor did it allow teachers to integrate technology into their instruction. In addition, teacher participants noted that previously, students had inequitable access to materials and devices, yet the curriculum required the same expectations for all. These teachers indicated that a disconnect existed between instructional strategies in a BYOD environment. Several teachers shared, “skills that they need to have, the collaboration, the deeper learning stuff,” is harder to achieve without a 1:1 learning environment. As such, one teacher explained, “The accessibility has been awesome, particularly from a teacher standpoint…and being able to come up with more innovative lesson plans has also been a lot easier for teachers.” Thus, the teachers emphasized the importance of equitable access to foster 21st century skills and deeper learning (DL) at Glendale Public Schools.

Next, the student and teacher participants indicated that the 1:1 program increases access to more relevant content. Because Glendale shifted content to digital platforms, the students expressed that they now have access to materials and resources that are more pertinent to the 21st century and the real-world. Before the 1:1 program, students reported, “They had less relevant resources to share stuff with us…and it's definitely affected the learning in my classrooms for the better.” For the most part, students and teachers emphasized that the 1:1 program has enhanced student engagement with relevant materials. Therefore, the teachers conveyed that the 1:1 program ensures anytime access to high-quality resources and content. One teacher noted, “There's just more content out there, more experiences out there, real-life experiences that you can get with technology that you can't with a textbook.” Many teachers reported incorporating recent events as they are happening, stating, “It allows us to sort of, with teachable moments like that.” In fact, most
teachers revealed that the technology created efficiencies for them. Because of the Google Platform, teachers heralded the ability to streamline materials preparation and organization.

Linked to access, the students and teachers also suggested that the 1:1 program has improved their overall organizational skills. The students and teachers noted because they can access Chrome anywhere, they can always find their materials, even if they do not have their device with them. The students and teachers also explained that the platform allows them to check to see if they remembered to submit their assignments and to set up notifications to ensure that they do not miss deadlines or assignments. Repeatedly, the students and teachers offered different ways in which the 1:1 program improved their organization.

The Glendale student and teacher participants indicated that access to digital resources makes learning and performance easier for students, while expanding their ability to apply their 21st century skills in their classes and the real-world. For example, the students discussed how they improved presentation skills because of the device. Several students described how they use their devices for self-direct projects, extra-curricular activities, internships, and work experiences that extend beyond the classroom. In fact, teachers in the focus groups who facilitate extra-curricular activities also conveyed that the devices had increased organization and 21st century skills in those setting as well. Four of the students also reported using the devices to engage in real-world, DL, not connected to their courses in their free time. As such, Greendale students emphasized increased motivation and opportunity to engage in self-directed, deeper learning.

Every student and most teacher participants suggested that universal access supports collaboration and presentation because they can engage with one another virtually when they are unable to meet physically. Most students and teachers also relayed that they improved their ability
to research and evaluate digital content since the inception. Repeatedly, the students and teachers reported improvements in research, presentation, and collaboration skills at Glendale High School.

In addition, many of the student and teacher participants indicated that the 1:1 program allows them to access their instructional materials even in their absence or their teachers’ absence. The students and teachers explained that when the teachers are absent, they frequently create and send students online lessons that include instructional videos. One student suggested, “I guess, helps us not fall behind in other classes or to the curriculum.” In fact, teachers reported a loss of overall instructional time due to absences. Similarly, the students explained that they keep up with their classes when they are not in school. Another student shared, “I would rather do my work on a day when I'm sick and not doing anything than coming back the next day and doing everything else.” Although not required or expected by teachers, most students prefer to keep up with their classmates when they are out. They revealed that they feel less stressed than when they try to make-up work and complete the new work all at once. Many teachers argued that the students now demonstrate improved academic mindsets. As one teacher stated, “I've seen a lot of my students take advantage of Google Classroom with absences in a really productive way. I'm noticing it more than last year, that they're already going to Google Classroom to check in to see what's due without even me having to tell them.” As such, the 1:1 devices are supporting “whenever, wherever” learning at Glendale Public Schools.

Although an overwhelming number of students reflected on stress and pressure to remain current and competitive in their studies, they also indicated that more flexible access to their assignments decreased stress. When asked the source of the pressure, the students revealed that they believe their parents expect them to outperform their peers to get into the most competitive colleges. As such, they felt conflicted about taking part in extra-curricular activities. Several
students indicated that with the Chromebooks, they can stay current with their studies while remaining involved in the activities that interest them. Students also compared their levels of stress about work completion, work submission, and group work before the 1:1 program. Most students reported that with the 1:1 they feel like they are in more control of their learning and that their improved organizational strategies support their performance. They reported improvement in their academic mindsets and understanding of themselves as learners. Thus, students conveyed an overall decrease in stress because of the increased flexibility afforded by the Glendale’s provision of a 1:1 device for all students.

The Glendale administrators and teachers also noted that universal access to resources supports differentiation of instruction (DI). For example, the administrators explained that, although the district encouraged DI before 1:1, teachers struggled to access the materials necessary to scaffold instruction. Additionally, the administrators outlined the benefits from increased access to assistive technology. One administrator shared her observations,

Some students who are in some of our special education settings are using the iPads to help accommodate certain things. For example, a student I watched yesterday was using the iPad. This student could make the letters a lot bigger so it was easy for the student to read because of some vision problems.

Thus, administrators reported a universal belief that the 1:1 solution increased equity and access to content, while also supporting Glendale students in meeting their educational objectives in ways previously impossible without 21st century skills or technology.

The administrators similarly emphasized that the enhanced accessibility to interventions and online learning opportunities via the 1:1 program has positively impacted student outcomes. For example, administrators relayed an increase in graduation rates for students who now access their
learning online, whose anxiety prevented regular class participation and attendance. The administrators reported that these students would not have managed to reach their post-secondary goals without the solutions available through the technologies. In addition, the administrators contended that many high-quality systems of intervention are available digitally in ways that allow teachers to reach more learners. Further, they revealed that the progress monitoring tools associated with these interventions suggest success in closing student educational gaps. Thus, the administrators attributed the 1:1 program’s assurance of resource equity and access with increased student performance at Glendale Public Schools.

Tensions exist between traditional instructional practices and 21st century, deeper learning strategies at Glendale Public Schools. Collectively, the administrators, students, and teachers suggested that the tension between traditional and 21st century instructional strategies lies in classroom management, as well as a philosophical push and pull relative to pedagogy. Importantly, the teachers acknowledged the challenges students face when teachers have such disparate expectations for technology use and integration. As such, the teachers stressed that as they become acclimated to teaching with a focus on 21st century skills and deeper learning (DL), the infusion of 1:1 has resulted in both positive and challenging situations and experiences.

The building administrators revealed that the open labs alleviated some of the tensions. They contended that the traditional physical plant prevented DL and 21st century activities from occurring. In their opinion, in freeing up labs, 1:1 has provided teachers the space required for transformational shifts. As one administrator explained, “What used to be a computer lab is now, in one case, is going to be changed into a maker space, which is moving us in that 21st century direction.” As such, the administrators collectively agreed that as they increase flexible learning
spaces at Glendale High School, teachers place greater emphasis on 21st century skills and DL competencies in their instructional practices.

Although the physical plant has alleviated some tensions, the administrator, student and teacher participants all revealed ongoing concerns relative to classroom management and expectations around teaching and learning. While the administrators reported that the 1:1 program has a positive impact on behavior and student management, they acknowledged teacher concerns with plagiarism and academic honesty. They explained that the teachers are using resources such as Turnitin to address this growing issue. Many teachers also conveyed concern about plagiarism, honesty, and student responsibility during the focus group conversations. Moreover, they wondered about the correct response to plagiarism. For example, one teacher offered, “Maybe we need to hold students more accountable for academic honesty. Here those issues of academic dishonesty sometimes are treated as a learning experience, and they get a chance to try again.” During discussions, the Glendale teacher participants shared their internal struggles with the shift toward technology integration and looked to each other for suggestions.

Most students recognized that some of their peers had broken the trust of their teachers. The students explained that with the technology, teachers can hold students more accountable for their work, which allows management issues to surface. One student stressed, “We definitely did have a couple issues with some students doing things with their computers they shouldn't be.” The students voiced appreciation that since the student issues are not the norm, teachers handle them on an individual basis. As such, the students conceded that with privilege comes responsibility.

In addition to fears that teachers expressed about plagiarism, the administrators also acknowledged apprehensions related to classroom management. They indicated that some teachers reported difficulty monitoring student activity on the devices. The students also admitted that
teachers might feel frustrated by students who do not follow expectations when using technology in class. As a student suggested, “There can be kids that just plain don't do anything at all. Most people do listen, but there are definitely lots of people that don't.” Importantly, students reported the frustration with their peers who do not follow the expectations. For the most part, the students ignore their off-task peers; however, several students stated that they were a distraction.

The teachers shared that the one of their more concerning classroom management issues involves students who forget their Chromebooks or forget to charge their Chromebooks. They find that when they allow students to access their personal devices, the students engage in distracting behaviors. The teachers explained that they struggle with this dilemma because not allowing students to access a device causes the student to miss important learning. Like several teachers expressed, “I think the computer can be both a hindrance and an asset at the same time.” As such, most teachers established that they continue to weigh the benefits and distractions.

Collectively, the administrators, students, and teachers argued, however, that the classroom management concerns around distractions exist with or without student 1:1 devices. For example, one student explained, “It's not like more people are keeping distracted, it's just the same people that were distracted last year, have more access to more distraction. So, I mean, it's their fault.” As such, to address classroom management issues, the Glendale administrators, students, and teachers reported a need to address student engagement and student-centered learning strategies.

Moreover, many Glendale student participants expressed frustration that the administration appears to hold teachers less accountable than students. For example, several students mentioned teachers who have lost their assignments. In these instances, the students explained that they used the technology available to navigate the misunderstanding. As one student explained, “It gives you a way to stand up for yourself a bit more.” Other students noted frustrations with teachers who did
not post assignments in agreement with the school expectations. Several Glendale student participants shared annoyance with what they perceived to be different standards of accountability for teachers and students.

However, many students also reported that the 1:1 program improved student-teacher relationships, particularly when they perceive teachers as valuing their voice and leadership. Most students shared their efforts at navigating the changing landscapes in their classes. Some students indicated that they attempt to build relationships with teachers. For example, one student articulated,

I can see that they really, really try very hard to make sure their students understand and they're very generally interested people. I can see that they're trying to adapt to the new technology the best they can, but for some of them, they didn't grow up with it so it's hard. I try and help them the best I can and they do their best, but sometimes it's just going to take time to adapt.

Other students conveyed no expectations that their teachers change, but placed the onus on themselves as learners to navigate the different expectations. Several Glendale student participants view the shift to 21st century teaching in a primarily positive light, noting, “I think they get a better interaction between students and teachers, and they have more, uh, involvement with students,” and “I think it brings the students closer to the teachers, overall.” For the most part, students acknowledged that the shift in instructional strategies to 21st century skills and DL is new, and that although they may not agree with teachers who are more traditional, positive relationships stem from student and teacher partnerships.

Like the students, most Glendale teacher participants reported that the technology increased student-teacher communication. These teachers conveyed that even the quiet and shy students are
reaching out to them more, as “some kids needed help, but they weren't asking for it.” Most teachers revealed that the transition to 1:1 has encouraged them to engage in more conversations with their students about learning. For example, a teacher shared how he has grown as an educator because of the student-teacher interactions,

I actually started to engage the students in conversations about learning, like actually have them read some articles that we've found, actually talk about what learning is. It's definitely different in the sense that I feel I always had a tendency to give them too many guidelines and requirements. Instead of that, letting them establish their own parameters of the assignment.

However, students noted mixed opportunities to provide their teachers with feedback about the 1:1 program. Several students suggested that teachers should provide more chances for students to given them feedback. In fact, most students reported that teachers request student comments and input into instruction at the start of the school year, but only a few teachers require feedback at regular intervals throughout the year. Overwhelmingly, the students expressed a desire to provide ongoing feedback regarding what works for them as learners. The clear majority of teachers posited, since technology integration is new for them, that they benefit from engaging in conversation with students and seeking their input.

The students overwhelmingly agreed that the 1:1 program has increased access to extra support from and communication with their teachers. Students reported that with the new technologies, teachers provide quicker communication and feedback. Also, all students emphasized that their teachers are always available to help them beyond the school day, in-person teacher help as well as virtually.
In addition, many teachers recognized improvements in their relationships with students, since they began using a flipped lesson approach. In a flipped lesson, the teacher provides the students with videos to watch at home, followed by a formative assessment for grouping in class. For example, one teacher explained how this model changed his relationship with students,

That's [flipped lessons] been really powerful since I made my first video, was how much more time I get to spend getting to know kids. I get to know them so much better and so much faster because I'm not standing up in front. You have real conversations with all the kids. Kids that hate math are enjoying being in the class because it's a more comfortable environment, and that's the piece that the technology has allowed me to do that I think sometimes people outside of education are going to lose sight of that thinking, ‘Oh they're just on screens, they're just sitting there looking at computers.’

Many teachers revealed that building relationships with their students allow for improvements in their efforts toward 21st century teaching and DL.

Some Glendale teacher participants reported struggling to motivate and involve students in the new model. They suggested that some students prefer the traditional lecture model where the teacher decides everything the student needs to know. These teachers acknowledged that in the traditional model, students are required to apply less and transfer fewer skills. They believed that some students prefer this model because they basically provide them with the roadmap to the good grade. The teacher participants noted that “sometimes they [students] need that interaction before it clicks,” and then the students become more engaged.

As such, teacher participants expressed differing degrees of student engagement resulting from the integration of technology. However, those teachers that incorporated technology on a more frequent basis argued that student engagement increased. Some teachers emphasized that they
worked on decreasing the emphasis on grades while increasing engagement. For example, one
teacher shared an ungraded project that he turned into a competition. He suggested that peer
interaction and feedback motivated the students. The teachers stressed that student engagement
increases when they see the personal or long-term value of an assignment.

Further, many teachers conveyed that in modeling their engagement and passion, they
observe increasing levels of student interest and motivation. In fact, one teacher stressed, “So for
my classroom, in twenty-one years of teaching, the last two have been far and away the most
exciting of my teaching career…my classroom is completely transformed.” Teachers also noted
increased engagement when topics relate to the real-world, areas of high-interest for students,
require hands-on activities, include simulations, or inquiry. Conversely, a few teachers in the math
and science departments revealed less student engagement in their lower level courses. However,
these same teachers also stated that they do not provide as many opportunities in these courses for
students to collaborate or engage with technology because they worried about managing student
behaviors.

Although the shift to 1:1 and the focus on DL and 21st century skills occurred over a year
ago, Glendale administrators noted some traditional instructional practices continue. They agreed
that some teachers rely on a lecture format, with very strict classroom rules. The administrators
revealed that because the district is high-performing, some teachers do not see the urgency in
changing instructional practices that appear to be working based on standardized assessments. In
addition, the administration conveyed that many of the lecture-based, pedagogical practices have
been in place for a long time. In fact, they argued that even some teachers who regularly use the
devices, continue to adhere to the traditional instructional methods.
The administrators noted that most teachers at Glendale High School had embraced the 21st century skills and DL competencies. Although some teachers teach these skills without the use of technology, the administrators suggested that the 1:1 program has stimulated a shift toward 21st century instruction. In fact, one administrator shared, “I think it revolutionized or updated how students learn and how teachers teach. It's just amazing.” In addition, the administrators revealed increased observations of group work, collaboration, differentiation, and student-centered learning. Still, the administrators acknowledged that instructional shifts that support 21st century skills and DL competencies are not yet universal at Glendale Public Schools.

The student participants also argued that teachers integrate 21st century strategies and DL to different degrees. Significantly, students observed differences in teacher readiness for 21st century teaching and learning based upon their experiences. The students indicated that technology integration supports educators and learners, but conveyed that some teachers are not ready. As one student noted, “It helps teachers just as much as it does students if the teachers are willing to adapt and get there. There are certain teachers; I don't think that they're capable.” At the same time, students stated that many teachers are prepared for technology integration and embed it based upon their goals and objectives.

The students offered many examples of teachers integrating technology to foster 21st century skills and DL. Some examples included flipped lessons, the use of station rotation, the integration of engaging and relevant digital resources, and the use of simulations. However, students also noted in some classes, “it's not a lot different.” The student reports centered primarily on individual teachers, not a global experience.
Where teachers shifted to more technology-embedded instructional approaches, Glendale student participants reported different degrees of satisfaction. On a positive note, one student shared how his teacher leverages technology to coach and facilitate learning,

He videoed all of our presentations. After that…we would pause it right there, where the thing was, in the presentation, we would comment what we thought we could do better in that presentation right there. We liked that a lot.

Conversely, another student offered, “I think the only problem I have with the increased use of technology in class is that, like in my language class, there's not ... nobody's really speaking. I think it's harder for me to learn that way.” Thus, student experiences varied from teacher to teacher, leading to different student preferences, adding another layer to the tensions between traditional and 21st century instructional strategies. Most student participants, however, preferred more student-centered classroom activities including the integration of technology and opportunities for critical thinking and collaboration. These students suggested that teachers integrate technology based on the purpose of the activity, with the goal of achieving DL.

As noted earlier, the student participants expressed irritation resulting from inconsistent expectations across teachers. For example, one student shared,

It takes away from having Chromebooks when 90% of the students' classes use the Chromebooks. Then, you go to this one class, and you're back to three-foot wide jumbles of papers. There are teachers that refuse to use the Chromebooks, because they just like their teaching style.

Almost all students reported frustration with teachers who refused to use the technology, or who did not allow students to access their devices. Repeatedly, Glendale student participants suggested that it would help them as learners if more consistent expectations regarding technology and 21st
century skills across classrooms existed. They recognized, however, that part of the inconsistent expectations may come from teacher inexperience with technology.

Consequently, inconsistent classroom rules and protocols around technology and instruction create tensions between 21st century and traditional teaching and learning at Glendale Public Schools. For the most part, teachers acknowledged this tension. As one teacher articulated,

I think this time in the history of education there is probably the biggest gaps in just the comfort level and expertise at using technology between the students and the faculty. I think that we recognize that there's ways that the students feel very comfortable and are confident learning with having Internet access. That's what gave us the drive to make that leap of faith."

However, another teacher shared, “If you are not comfortable with the technology, you're not going to be comfortable using it to change the way you teach.” Thus, the teacher participants conveyed that not all of their Glendale colleagues engage in 21st century instructional strategies and DL.

In the simplest form of transformational practices, as previously indicated, the Glendale teacher participated reported that technology has allowed them to access and provide students with more relevant materials and assignments. As one teacher expressed, in this sense, “Having a device, that has changed and transformed the way that I teach in my classroom.” Overwhelmingly, the teachers reported using Google Classroom efficiently and effectively for the provision of lessons, resources, due dates, and communication.

In addition, several Glendale teachers shifted their instructional practices altogether, using such models as flipped classroom. These teachers argued that they see increased student performance with the inception of 21st century models of instruction. In fact, one teacher celebrated the model, “I've definitely seen an increase in performance the last two years compared
to previous years with other classes. Just comparing my own kids to previous years, and even looking at summative assessment in terms of finals, comparing with other classrooms.” However, many Glendale teachers continue to struggle to integrate technology and have not moved to models of instruction, such as flipped.

Even teachers who have not fully integrated 21st century teaching models into their classrooms highlighted an improvement in feedback and assessment strategies because of the 1:1 program. Similarly, the administrators agreed that the use of technology has led to much-improved assessment practices and student performance. They stated that the 1:1 program affords students greater access to communication with and feedback from their teachers, supporting students’ ability to improve their performance.

The teachers relayed that Google Docs allows them to observe student work in real time, provide direct feedback and comments, and conference with students more efficiently and effectively. The teachers indicated that feedback using Google Docs has resulted in improved student performance and written expression skills. In addition, most teachers noted an increase in students requested and responding to feedback because the technology eliminates barriers such as time, location, and shyness. Moreover, many teachers revealed that the use of digital formative assessments helps them target instruction to student need while providing students insights into where they are in their learning. As one teacher explained, “They're getting instant feedback as they go, so if they're not getting something, they know instantly that they're not getting it. Then, at the same time, I'm getting that instant feedback.” Repeatedly, the Glendale teacher participants relayed increases in student performance resulting from the incorporation of digital formative assessments into their instruction.
Although the teacher participants stressed the importance of feedback and formative assessment, they also shared philosophical struggles with the current grading system. Part of the disconnect, teachers explained, is that parents cannot see the rich, formative work occurring in Classroom. Parents are only able to see summative grades in Aspen, the instructional management system. As one teacher expressed, “there's a disconnect there that makes feedback difficult sometimes, I think.” Hence, many Glendale parents do not see their child's growth, nor do they understand the deep connection between technology integration, formative assessment, and the acquisition of content knowledge, 21st century skills, and DL.

On a related note, several teachers elaborated on some of the struggles Glendale teachers face with DL and grades. For example, one teacher shared, “I see the value in 1:1 as a tool for deeper learning, but we need a significant paradigm shift in the building because while teachers may be committed to the idea of learning over grades, kids care about grades.” These teachers emphasized part of the instructional tensions derive from the need for students to experience a shift in culture, to learn for the love of learning. In their opinion, traditional grades are holding back the work, and stress without a shift to standards-based grading and project-based learning, a strong focus on 21st century skills and DL will not occur. Glendale student participants reported that they wished teachers would eliminate grades. They stated that grades hold them back from appreciating learning to learn. As such, students emphasized that grades are stressful, and they believe only teachers and parents value them. Even with the disconnect between grades and feedback, the Glendale teachers conveyed that digital formative assessments allowed them to differentiate their instruction better to meet the student needs.

One of the greatest benefits of 1:1 reported by the Glendale teacher and administrator participants is their ability to differentiate instruction (DI) with the aid of the technology. The focus
on formative assessments results in greater opportunities at Glendale Public Schools for differentiation, feedback, and instructional shifts to meet the needs of the students. In other words, the administrators noted that the technology permits teachers to assess where students are in meeting their learning targets, and provide differentiated instruction (DI) based on the data. As noted previously, the administrators agreed that DI has been a district goal, but that teachers struggled to differentiate without the 1:1 program in the past. As one teacher explained,

It's just not humanly possible to really differentiate the way we know we should be, and it's been one of these things that I think as educators, that you're made to feel like failures because we can't differentiate at the level that we know we should. The technology allows us to actually do it, you can get that data and know which kids are having trouble with a concept and do something about it, and they know where they're having trouble with a concept so they can do something about it. That's a really powerful piece of this.

Some DI strategies outlined by teachers included annotation, accessible text, parallel texts, infographics, graphic organizers, parallel assignments, choice in the presentation of learning, and peer tutoring. Another teacher shared, “What's beautiful about it for me I think is that no one feels like they don't know anything in the class. They all feel empowered.” Overall, the teachers who reported using technology daily emphasized student improvements with technology based DI, while those that did not continue to struggle with more traditional models of DI.

Several teacher participants conveyed that technology provides opportunities for students to revisit the instruction when they have difficulty grasping a concept. For example, many teachers reported providing students with videos of their lessons or tutorial lessons as instructional resources. The teachers incorporating video suggested, “it's minimized my lecture. I still want it to give them an informal lecture, but the videos reinforce that” and allow students to practice and
interact differently with the materials. During the discussion on videos as an instructional strategy, teachers who did not use videos in their instruction voiced interest in learning more about the strategy, and questioned the disparate experiences of students from teacher to teacher.

Finally, many teachers emphasized an increase in their ability to use technology to provide interdisciplinary lessons for students. Several teachers gave examples of courses specifically designed to be interdisciplinary, such as American Studies. Other teachers shared examples of interdisciplinary lessons they developed with the technologies and resources available within their courses. For example, several science teachers provided examples of lessons that spanned science, technology, mathematics, engineering, and societal issues. In these instances, the science teachers conveyed that they collaborated with other disciplines while incorporating digital resources and collaborative activities for student application of learning.

However, many Glendale teacher participants emphasized that even with technology, interdisciplinary lessons are challenging to develop and deliver. Teachers stressed the difficulty of collaborating across departments because of time and location. In fact, one teacher articulated, “I think the thing I would like to see us move towards the most with deeper learning, and the 1:1 will help facilitate this, is trying to find creative ways to develop more interdisciplinary approaches to teaching.” In sum, the teachers stressed the importance of interdisciplinary learning’s ability to support student transfer of skills across content areas at Glendale High School, while acknowledging the challenges.

Overall, the teacher participants admitted that although “DL strategies are not efficient,” the DL competencies and 21st century skills are critical for student success in college and career. The teachers expressed feelings of stress and anxiety in transitioning from breadth over depth. In trying to maintain common assessments and pacing, for example, teachers articulated a tension between
DL and traditional teaching. However, they also shared a desire to resolve the conflict created by the push and pull because they value the opportunity to increase content knowledge, 21st century skills, and DL. Universally, the administrators in the focus groups perceived overall positive impacts on teaching, learning, 21st century skill acquisition, DL, and behavior resulting from the 1:1 program. The administrators collectively acknowledged that many of the positive changes are in their infancy stages, but believe the 1:1 program increases Glendale students’ achievement, acquisition of 21st century skills, and DL competencies.

Glendale’s 1:1 program and instructional shifts increase student acquisition of deeper learning competencies and 21st century skills. Directly related to the DL competencies and 21st century skills, the administrator, teacher and student participants acknowledged that the 1:1 program provides increased opportunities for collaboration, communication, critical thinking, creativity, real-world learning, student ownership, self-directed learning, and academic content knowledge. One administrator explained, “We've got ties to a deeper learning…it allows for instruction time in the classroom to allow for more time to go deeper into some of their learning than it did in the past. In fact, all students stressed that the school provided a rigorous academic program and held students to high expectations. Moreover, through the teacher discussions, an overwhelming number of lesson samples and student work samples revealed evidence of 21st century skills and DL competencies.

Overall, the administrators, teachers, and students agreed that the 1:1 program increased and improved student communication and collaboration skills at Glendale High School. All administrators noted an increase in teachers designing opportunities for collaboration and critical thinking centered on real-world learning, which “will allow us to bring that type of collaboration to the classroom in a very productive way that prepares them for college and the workforce.”
Repeatedly, the administrators emphasized that they observed daily evidence of student collaboration. In fact, throughout the discussions, the administrators provided examples of collaboration visible in their regular learning walks. In addition, they recognized collaboration as a successful outcome of the Glendale 1:1 program.

Most student participants also agreed, that collaboration increases engagement and achievement. Moreover, all students indicated that the teachers provide ample opportunities for collaboration with their peers. In addition, students contended that Google Docs and Classroom increase opportunities for collaboration and communication. One student explained,

Students still communicate on our phones mostly, but the thing is with Google Docs it's the biggest upside of it… that's where the Chromebooks, I don't know, excel most in my opinion. The real-time editing is … Yeah, Chromebooks, there's that. They did that.

As such, the students reported appreciating the ability to share and collaborate on their documents in real time with peers and teachers. Similarly, the teachers and administrators also stated that the 1:1 program supported an increase in teacher-student communication and feedback resulting in improved academic achievement. For example, one administrator shared an observation,

Students were working in groups on a certain writing project. While they're working, the teacher was monitoring the class and seeing exactly what's happening in the groups, and individually, and able to, on the fly, so to speak, work with those students and start to edit.

Additionally, several students expressed that engaging in Google Hangouts with peers allowed them to reach help, collaborate and prepare for presentations and assessments in real-time, whenever and wherever. Importantly, students suggested that collaborative learning improves their communication skills, as well as their ability to navigate decision-making, compromise, and problem-solving
One teacher stated, “I think Google Classroom profoundly impacted how we teach it, completely revolutionized collaborative learning, and how we can expect the learning environment to go beyond the classroom.” Throughout the sessions, teachers explained that Google Docs and Hangouts provided enhanced opportunities for students to work together in person and virtually. All the English (ELA) teachers expressed that the ability to collaborate using Google Docs has resulted in improved student reading and writing. The ELA teachers indicated that students voiced appreciation for peer collaboration and feedback. In fact, the teachers reported that students independently choose to collaborate on Hangouts when they are studying for assessments.

Several math teachers noted that “collaboration is key in that because it's a problem that you really can't tackle by yourself. Because then you can have those really deep questions. It fosters a really good conversation as well.” Other examples of student collaboration and communication included shared projects, debates, presentations, and analysis of document based questions. Although the teachers agreed that the 1:1 program encouraged collaboration and communication, some shared apprehension about students relying on technology too much for communication. They suggested that when they notice collaborative groups working silently, they coach the teams about in-person communication. The teachers and administrators concluded that Glendale students require strong communication and collaboration skills to be prepared for life beyond high school, and the 1:1 program has fostered that readiness.

The Glendale administrators reported that 1:1, and increased access to the technologies connected to those devices, allows students to problem solve and critically think in new and novel ways. For example, “having access to 3-D printers, 3-D pens, circuits, all of that allows for creative problem solving, thinking. The administrators celebrated examples of critical thinking across the district’s classrooms, which they reported increased student engagement.
The student participants emphasized the importance of critical thinking and suggested that the Glendale 1:1 program supported increased opportunities for problem-solving. Some of the courses outlined by students were technology specific, such as AP Java, Python, and computer aided drafting. The students noted that even without technology at the center, their classes increased their emphasis on critical thinking. These courses included Advanced Placement (AP) courses, literature courses, and physics courses to name a few. One student shared in a new course available to students, “…Zombies, Plagues, and Aliens. We analyzed and wrote papers on post-apocalyptic literature, which sounds like a really easy class, but it's actually one of; I would say, one of the harder classes I took that year.” The students indicated that although the technology might offer some additional opportunities for critical thinking, Glendale course curricula are such that students are required to think critically and problem-solve on a regular basis.

As a high-performing high school, the teacher participants stressed that regardless of the instructional model, rigor in academic content remains at the helm. Because of the culture of the school and family expectations, students focus heavily on their academic content. As such, the technology has supported their work in going deeper. For example, the math department shared, “so our goal this year for these 21st century learning expectations and everything is to try to get into these more deeper lessons because technology now lends itself to shorten some things, get some more things front-loaded for us to really dig deep.” Thus, the integration of technology has allowed Glendale students to continue to gain academic content knowledge while building 21st century skills and DL competencies.

Linked to DL, the administrators collectively identified self-directed learning (SDL) as an essential competency for post-secondary readiness. Universally the administrators suggested that because of 1:1, they notice increases in SDL. One administrator explained, “what you see is…we
students taking ownership of their learning, are they the ones that are coming up with the questions, and all of those pieces.” While another administrator added, “They can self-pace, they can be the driver of their own learning, and I think that’s an important piece of 21st century learning.” As such, administrators expressed that the 1:1 program supports their goal of increasing SDL in students. Collectively the administrators reported access to the 1:1 devices, impacts Glendale students’ ability to reach or be prepared for their post-secondary goals through the focus on 21st century skills and DL competencies.

More than half of the student participants contended that the 1:1 program placed more responsibility on them as learners, while providing them the tools to be self-directed. As such, 21st century teaching expectations and deeper learning competencies enhance student voice and leadership. One way in which this leadership manifested itself is STAT. Every student expressed pride in knowing that the STAT team was student developed, organized and run. In fact, all participants indicated, the students take the STAT team very seriously. One focus group participant, a member of STAT, shared,

I have worked on parts of this support system so this might be biased, but I think we, on STAT, tried to provide a, if not an immediate solution, a good experience to make sure the student is being serviced educationally and is also not having a terrible experience with us and with the district. Obviously, there's going to be room for improvement, but there always is.

The STAT support and leadership have grown over the course of the two years, and they now manage between 1500 and 2000 devices. In fact, the STAT team is in the process of building capacity with middle school students. As such, the students emphasized that their peers on the team are essential to supporting the hardware and software necessary for technology integration.
Additionally, the students expressed leadership in supporting classroom integration of technology and building teacher capacity. As one student explained, “what people, especially teachers, really expect out of STAT, is not only can we come down and fix their issue, but we can show them how we fix it, so they become more knowledgeable.” Teachers and students easily recognize members of the STAT team by their green Chromebook cases, increasing their ability to help in the classroom. Universally, the students articulated that STAT elevated student interns to leaders among peers and adults. Moreover, all students reported STAT as essential to supporting technology infused, deeper learning opportunities in the Glendale classrooms.

The teachers noted an increase in SDL since the inception of 1:1. As one teacher articulated, “I feel the 1:1 initiative addresses that and lets students work at their own pace.” The teachers explained increased student responsibility is a major component of SDL. For example, teachers reported that students are improving their ability to select projects that are rigorous, yet passion-based. In the context of the sessions, teachers shared assignments and student work that included high-levels of research accompanied by projects that afforded students with significant choice and responsibility as learners. One teacher described how he used an economics project to foster SDL while maintaining the integrity and rigor of the research,

All the students in the class would choose a country with an economic standing in the world. Every student had to do a paper diagnosing the current economic health of that country. Then they have a considerable access to these different forms of media that they can put together music and lyrics and make a song, create a poem, make a political cartoon. The first piece of taking that actual research of the country is important for them to understand and get a feel of where this country stands in the world currently, but then having those
other options of those other projects to go beyond the research and pick and choose the types of products the kids are more comfortable creating.

In encouraging SDL, teachers agreed that Glendale students have more opportunities for creativity. Teachers celebrated high levels of student creativity that include strong academic content and critical thinking. Examples of student work included songs, poems, documentaries, and even student-designed assessments. In one social studies course, students created an assessment tool for the products that they designed and presented to the class on sports and race. The teacher explained,

The topics ranged from the St. Louis Rams, "Hands up, don't shoot!" pose in 2014, to Jackie Robinson and Pee Wee Reese in 1947, “It's over time.” One group created a blog page on Kaepernick. A couple groups created websites. One group did a really cool Facebook page on Arthur Ashe. The 1:1 obviously was crucial there because they were all engaging the product together, working in Google Docs creating digital product. I was very much on the outside looking in, facilitating. I really didn't want them to ask me questions. I wanted them to figure things out on their own.

The teachers also emphasized the importance of providing an audience for the student products. For example, another teacher offered an example of passion-based speeches students wrote and delivered after studying such figures as Martin Luther King, Patrick Henry, and Emma Watson. He shared that “critical thinking skills… also creative thinking too, communication skills, social skills are really the point of the lesson.” Unequivocally, teachers in every Glendale core department stressed an increase in student products that were of high quality, rigorous, aligned to the content standards, and creative at the same time.
In addition, the student participants reported that opportunities for student ownership of their learning increased engagement and opportunity for skill acquisition and application. The students explained that teachers afford greater opportunities for students to select projects that they are passionate about to demonstrate their learning. Moreover, some students believed that the technology allowed for a shift in both content relevance and student engagement arguing, “You wouldn't get as much knowledge.” Further, most students contended that the technology allowed them to improve their own 21st century skills while improving engagement and motivation. Overall, the students reported since the 1:1 program, Glendale teachers have increased the opportunities for students to select engaging projects or performance tasks.

One junior suggested, “Where technology adapts to the curriculum. I think the next wave, which is starting to happen, is where we take advantage of this new paradigm where students can have more control of their own education.” Almost all students described opportunities for choice in assignment and projects. In fact, nearly all students indicated that since the 1:1 program began, teachers have afforded students a greater voice in how they demonstrate their learning. However, they also noted that some teachers do not offer any choice, and they reported they do not find those classes as meaningful. Thus, the students emphasized the importance of being given opportunities to determine how they learn best, including when to use their devices.

In addition, the student participants pointed to understanding themselves as learners more with the technology. They argued that using the technology helped them improve their organization, writing, communication, and collaboration skills. Other students noted that 1:1 allows students to access the help they need without slowing down the class. At the same time, the students expressed differing opinions related to how the 1:1 program has impacted them as learners. One student contemplated, “I don't know if it's fundamentally changed me in my learning style and
how I study for stuff. It's changed the way I've studied, but I don't think yet it's changed the way that I've learned.” Some students also stated that although they are not certain if it changed them as a learner, it allowed them to be more efficient learners.

Most teacher participants offered that the 1:1 program has increased student ownership of their learning, including their academic mindsets and ability “to shift onto learning, how we learn, why we're learning what we're learning, and the value of learning.” Throughout the discussions, teachers revealed that the 1:1 program and focus on DL has allowed students to understand themselves as learners more and to develop growth mindsets. For example, the science department, although mixed in their use of the Chromebooks, shared, “It leads to the application of content versus just memorization of content. That has been very positive in application, not just memorizing, but applying and reflecting.” In fact, the teachers noted that the program has required them to transfer ownership of learning and decision-making to their students. Additionally, teachers suggested that students now engage deeply in their learning in ways they would not have imagined. Many teachers conveyed an internal struggle with “handing over the reins,” but emphasized that Glendale students are becoming more independent and successful in their mastery of 21st century skills, DL competencies, and academic content knowledge.

The administrator participants noted a shift in student ownership of their learning. They articulated that students are beginning to let teachers know what works for them academically, and expressed the need to encourage continuous improvement dialog. The administrators typically agreed that they observed students inform their teachers of the instructional strategies best-aligned to their needs. However, most of the administrators stated that they would like to see even greater evidence of student ownership of their learning at Glendale High School and opportunities for students to provide feedback to their teachers.
Student participants also reported that the school and the 1:1 program provided more opportunities for real-world learning. Some of the real-world learning takes the form of after school and elective opportunities. Students referenced real-life learning in clubs and activities such as theater, television production, and robotics to name a few. Additionally, students pointed to engaging course content in classes such as entrepreneurship, pre-engineering, and personal finance. Several students also conveyed that they valued hands-on simulations and internship opportunities. As such, the Glendale student participants argued that the courses that provide opportunities for real-world learning and hands-on application are the most meaningful to them.

Most student participants also reported that the school could improve their efforts at preparing students for the real-world. One student commented, “it's more like we're being taught to be teachers rather than being taught to be a different occupation.” Another student argued, “we're not connecting enough back to why we're actually learning it in real-life stuff.” Moreover, the students contended that the school, other students, and their parents place too much emphasis on grades and tests. For example, a student stated, “I don't think teachers are enforcing enough that it's not necessarily about the test, but more so about learning the material and applying it.” Overall, students repeatedly emphasized the desire for more real-world opportunities and application of that learning at Glendale High School.

The students suggested that the STAT team is a prime example of the school using the new technology to prepare students for the real-world. First, the students shared that the STAT team is learning to collaborate with other people in a professional environment. The students stressed that the school treats STAT as a professional organization. One student explained, “it's preparing us for more things in the future, for us.” As such, students contended that the 1:1 program increases their
opportunities for self-directed learning at Glendale High School, with STAT as their primary example.

In requiring authentic audiences, the teacher participants emphasized that they fostered opportunities for real-world learning. The teachers shared that technology integration has increased student opportunities to solve real-world problems. Although some of these problems included simulations, teachers revealed most problems engaged authentic audiences. Examples of real-world learning included persuasive student speeches to the school committee, dynamic-capstone projects including internships, authentic products for local businesses, exit polls and analysis during political elections, and investigations of societal issues such as over-fishing of cod in Georges Bank, to name a few.

The administrators acknowledged that DL competencies and 21st century skills are as new for them as they are for the teachers and students. However, the administrators shared that they are increasing their understanding the more they visit classrooms. One administrator’s observations revealed,

I can think of several times where I've been watching a group of students solves a math problem together. The collaboration and the excitement of solving that math problem have been really impressive, and you know they're just figuring out themselves, and then somebody runs over to the computer and checks, looks something up to find to help with solving the problem. So, I think, that's what they're going to be doing in the workplace, and that's 4th and 5th grade. They're doing it.

Thus, although Glendale Public Schools has only recently implemented 1:1 and a commitment to DL, the administrators emphasized a growing shift in instructional practices aligned to 21st century
skills and deeper learning competencies. Overwhelmingly, the students and teachers agreed that the 1:1 program supports the acquisition of 21st century skills at Glendale High School.

**Document Review**

In addition, the focus group discussions with administrators, students, and teachers, this researcher collected and examined a variety of documents relative to the 1:1 program and the integration of technology to foster deeper learning and 21st century skills. These documents included the website, program of studies, student handbook, lesson plans and student work.

**Website.** The district website includes a landing page and resources to support communication and understanding of the district 1:1 program. The district posted its technology strategic plan and supporting documents on its website. In the technology plan, the district focused on five areas in planning and implementing the 1:1 program. Those five areas include, “Learning: Engage and Empower; Assessment: Measure What Matters; Teaching: Prepare and Connect; Infrastructure: Access and Enable; and Productivity: Redesign and Transform.” The document includes the five-year implementation cycle and supporting resources employed by the technology subcommittee in developing the plan.

In addition to the strategic technology plan, the landing page includes supporting documents, frequently asked questions, parent resources, and six compelling reasons why the district decided to implement 1:1. The reasons are aligned to the levers in the strategic plan and include, equity and access to curriculum and technology, critical thinking, creativity, collaboration and communication, the ability to differentiate more effectively, and assessment to inform instruction. As is evident from the above levers and reasons, the administrators’ comments during the focus group discussion point to clear alignment to the strategic plan and the value Glendale places on the plan’s support of leveraging technology to transform teaching and learning.
The district website also includes parent communications regarding the 1:1 program, parent forums, and related resources. Such resources include videos of past presentations, frequently asked questions, and parent tools from Common-Sense Media. Each school website displays their Common-Sense Media certification and parent links. In addition, school committee presentations entitled “Spotlight on Learning” and Twitter feeds reveal school and district communications demonstrating teacher integration of technology to support student achievement of 21st century skills and Deeper Learning competencies. Although, there is little evidence of district to teacher communication regarding top-down expectations of technology integration; there is significant evidence of professional development on cyber safety, 21st century skills, technology integration, and deeper learning. As such, the district website reinforces many of the themes discovered through the focus group discussions about strategic planning, communication, and systems of support for the integration of technology to foster 21st century skills and deeper learning.

**Program of studies.** The program of studies includes the courses, curriculum overviews, graduation requirements, and expectations of the school. The school offers a wide array of courses including seventeen Advanced Placement courses, interdisciplinary courses, pathways in pre-engineering, television production, and business, arts and music courses, technology courses, a variety of eclectic electives, and internships. The variety of courses suggests teacher autonomy and opportunities for experimentation. Further, the program of studies provides additional evidence for the emphasis on academic content, application of learning, and some interdisciplinary opportunities.

**Student Handbook.** The student handbook outlines expectations for student behavior and learning. In addition, the academic expectations are also highlighted in the book, providing additional emphasis on academic content at the school. The handbook outlines the student academic expectations, including, problem-solving, literacy, technology, understanding the world
community, and the arts. Additionally, the handbook outlines the social and civic expectations that encompass responsibility and integrity. One of the social expectations is the development of an Individual Learning Plan, providing evidence of the emphasis on self-directed learning. Woven into the handbooks is the district responsible use policy, providing additional emphasis on access to materials and resources. Also, important to note, in addition to its inclusion in the civic expectations, academic honesty is included in its own section in the handbook. Finally, the handbook includes the district homework policy, which emphasizes the importance of evaluating the relevance of any work beyond the school day. Thus, the student handbook reinforces the themes of 21st century skills, deeper learning competencies, communication, and expectations for learning captured during the focus group discussions.

**Teacher lesson plans and student work samples.** The researcher embedded examples of the lesson plans and student work samples throughout themes garnered from the focus groups. The lesson plans and work samples illustrate the opportunities for interdisciplinary learning, collaboration, and communication, critical thinking, problem solving, real-world application, rigorous academic expectations, student self-direction, creativity and 21st century skills. The emphasis on the skills and competencies highlighted in the work samples provide evidence for the theme relative to 1:1 programs fostering deeper learning. This theme was articulated clearly in each of these plans and samples.

**Summary of Findings**

This study is a case study of Glendale Public Schools’ transition to 1:1 technology integration to foster 21st century skills and deeper learning. The researcher facilitated fourteen focus group discussions including seven administrators, eighteen students and seventeen teachers.
In addition, the researcher examined print and web materials to triangulate the data from the focus group discussions.

The themes from administrators, students and teachers about how the district organized itself to support technology integration by teachers with the specific intent of fostering deeper learning and 21\textsuperscript{st} century skills included:

A. Strategic planning and reliable systems were essential for Glendale’s 1:1 initiative to drive 21\textsuperscript{st} century skills and deeper learning.

B. A reliable infrastructure and compatible hardware and software were necessary to support technology integration, 21\textsuperscript{st} century skills, and deeper learning competencies at Glendale Public Schools.

C. Communication around roll-out, implementation and teaching and learning expectations were critical to Glendale’s transition to 21\textsuperscript{st} century educational environments.

D. On-going support for technology integration into instruction was critical to developing 21st century skills and deeper learning at Glendale Public Schools.

The themes from administrators, students, and teachers relative to their perception of the implementation of 1:1 and its impact on 21\textsuperscript{st} century skills and deeper learning included:

A. Equity of 1:1 devices and access to resources have positive educational impacts on Glendale student learning.

B. 1:1 devices led to improved assessment strategies and actionable feedback, resulting in increased student performance at Glendale Public Schools.

C. Tensions exist between traditional instructional practices and 21\textsuperscript{st} century, deeper learning strategies at Glendale Public Schools.
D. Glendale’s 1:1 programs increased opportunities for acquisition of deeper learning competencies and 21st century skills.

To summarize the themes, administrators emphasized the importance of strategic planning as the organizational structure necessary to support technology to foster deeper learning and 21st century skills at Glendale Public Schools. As part of the process, they articulated the critical role of communicating expectations relative to technology integrations. The administrators emphasized their role in providing the supports necessary to ensure technology integration resulted in 21st century skill acquisition. Although the administrators outlined the structures necessary for a successful program, they also provided insights into areas for improvement such as communication of clear expectations. Even though the administrators acknowledge areas where their structures and systems required development, they revealed a positive perception of the implementation of 1:1 and its impact on 21st century skills and deeper learning including the equity of devices, universal access to materials, and evidence of 21st century skills and deeper learning in the classrooms. The administrators acknowledged that tensions continue to exist at Glendale Public Schools between traditional and 21st century instructional practices. Since they are in the early stages of 1:1 and technology integration, Glendale administrators emphasize that these tensions will require their attention moving forward.

Student responses suggest that Glendale Public Schools’ organizational structures for 1:1 and technology integration support them as learners. The students emphasized that equitable access to devices and resources, as well as a reliable infrastructure, aid in their acquisition of 21st century skills and deeper learning. However, they perceived the lack of instructional support for teachers and unclear communication with parents as barriers to their progress. Like the administrators, they saw the 1:1 program as having positive impacts on them as learners, increasing their voice and
leadership, while improving their 21st century skills and deeper learning competencies. Also, like
the administrators, they defined the tensions between traditional and 21st century instructional
strategies as areas of continued frustration.

Finally, the reports from the teachers largely mirror those of the administrators and students.
The teachers championed Glendale’s equitable provision of devices and resources to students.
They also acknowledge a reliable infrastructure and opportunities for teacher collaboration as
conducive to meeting the goals of technology integration to foster 21st century and deeper learning.
On the other hand, the teachers emphasized areas of improvements in Glendale’s structures are
necessary including, communication, clear expectations, and job-embedded supports. In their
perception, the 1:1 implementation has resulted in improved student performance resulting from
equity, access, enhanced instructional practices, and organizational tools. Teachers also recognized
increased opportunities for students to acquire 21st century skills and deeper learning because of
Glendale’s 1:1 program. Finally, the teachers acknowledged the tensions between traditional
instructional practices and 21st century, deeper learning. Due to the alignment of themes between
participant groups, each of the themes presented in this chapter is important for Glendale Public
Schools to consider in their continued support for 1:1 technology integration to foster 21st century
skills and deeper learning.
Chapter V: Discussion of the Findings

Revisiting the Problem of Practice

Public schools across the country are quickly moving to learning environments that afford students with 1:1 access to technology. However, substantial concern exists regarding the readiness of teachers and the ability of these 1:1 initiatives to influence teaching and learning (Friday Institute, 2011; Groff; 2013; OECD, 2015a; Topper & Lancaster, 2013). Many districts implement 1:1 initiatives with little planning or insufficient, poorly designed professional learning opportunities (Topper & Lancaster, 2013). In fact, a significant number of 1:1 rollouts lack a clear vision or goals, and fail to include teachers and students as collaborative partners in implementation (Holcomb, 2009; Topper &; Lancaster, 2013; Project Tomorrow, 2015). To date, relatively few studies have focused on the organizational structures, practices, and resources needed to support technology integration to achieve 21st century skills and deeper learning competencies. Little research exists describing the experiences of teachers and students regarding the supports and structures that help them achieve these potential benefits effectively.

Thus, the purpose of this study was to understand administrator, student, and teacher perceptions of the potential for technology integration to achieve 21st century skill acquisition and deeper learning (DL) in a 1:1 environment. Also, this study sought to understand the organizational structures and supports administrators, teachers, and students perceive as necessary and useful to provide opportunities for students to achieve 21st century skills and DL competencies in a 1:1 environment. Thus, the findings from this study may provide a set of recommended strategies, practices, or systems of support that district and school leaders could employ to foster 21st century skills and DL in 1:1 environments as experienced in the district referred to in this study as Glendale Public Schools.
Review of Methodology

This instrumental case study examined Glendale’s implementation of 1:1 technology to foster 21st century skills acquisition and deeper learning (DL) competencies. To meet the purpose outlined above, the study was framed by the following research questions:

1. How has the district organized itself to support technology integration by teacher with the specific intent of fostering deeper learning and 21st century skills?
2. How do administrators, teachers, and students perceive the implementation of 1:1 and its impact on 21st century skills and deeper learning?

As such, this research study investigated how administrators, teachers, and students in the Glendale Public Schools understand and perceive the district’s organizational structures and support for 1:1 to foster 21st century skills and deeper learning (DL).

To achieve the goals of this study, the researcher selected one suburban district in its second year of 1:1 implementation. The research design included focus group discussions with district administrators, building administrators, students in grades nine through twelve, and core content teachers. The focus group discussions provided the administrators, teachers, and students the opportunity to share their perceptions of the district’s 1:1 implementation and associated support structures. Also, the focus group discussions allowed the administrators, teachers, and students to explain their understanding of the impact of 1:1 on teaching and learning. To that end, teachers and students provided documents, including student work samples and lesson plans, and anecdotes of 21st century skills and DL in the classroom. Through the focus group format, the participants engaged in an informal dialog, built on each other’s comments, and shared their opinions with the researcher and one another. As the case study methodology is best suited to studies that examine a specific phenomenon within the boundaries of its natural context, the
researcher selected administrators, students, and teachers from Glendale Public Schools and Glendale High School to understand the research questions framing the study (Stake, 1994; 1995).

After conducting the focus groups, the researcher transcribed the discussions using Rev.com. She then uploaded the transcription data into MaxQDA software for coding and analysis. The researcher also reviewed and analyzed student work samples, lesson plans, the program of studies, the student handbook, and the website to triangulate the data with the information gleaned from the focus groups. She employed In-vivo and descriptive coding to develop themes aligned with the research questions. Finally, through careful review and analysis, the researcher developed findings from the identified themes.

In the following sections of this chapter, the researcher presents a discussion of major findings, a discussion of findings connected to the theoretical framework, a discussion of findings aligned with the literature review, final analysis, recommendations, significance of the study, limitations, and considerations for future research.

**Discussion of Major Findings**

After careful review of the themes that emerged from data collection and review in Chapter Four of this study, four major findings surfaced including:

1. Glendale Public Schools’ implementation of 1:1 for 21st century skills acquisition and deeper learning (DL) benefited from engaging multiple stakeholder groups in the ongoing strategic planning, transparent goal setting, and implementation of 1:1 plans.
2. The 1:1 initiative, as rolled out and implemented in Glendale, ensured the purposeful integration of technology in content and pedagogy by providing multiple opportunities for two-way dialogue and significant communication amongst teachers, parents, and students.
3. Glendale’s 1:1 initiative fostered and supported teachers’ transformation of teaching and learning toward the acquisition of deeper learning and 21st century skills by the district providing them with a reliable infrastructure, technology, job-embedded professional learning, peer-to-peer collaboration opportunities, and recognition from their administrators.

4. In Glendale, the 1:1 initiative increased students’ engagement in and development of deeper learning competencies and 21st century skills in classrooms that purposefully integrate technology when teaching and learning expectations are in place and attended to.

Glendale Public Schools’ implementation of 1:1 for 21st century skills acquisition and deeper learning (DL) benefited from engaging multiple stakeholder groups in the ongoing strategic planning, transparent goal setting, and implementation of 1:1 plans. Throughout the focus group sessions, the administrators emphasized the importance of strategic planning and goal setting to successfully implement 1:1 to foster 21st century skill acquisition and (DL) competencies. The Glendale administrators referenced a district technology committee’s work in developing the initial plan. Members of the committee included teachers, parents, administrators, and community members. Although Glendale did not include students on the committee, the administrators mentioned that they involved students later through the Student Technology Assistance Team (STAT). The STAT team supports 1:1 technology at Glendale Middle and High School, taking an active student leadership role in the district.

Repeatedly, the students and teachers revealed the significance of their voice, as well as that of parents and community members, in the development, goal setting, and implementation of the plan. Overwhelming, participants agreed that transparent communication of the purpose of the plan
was necessary to achieve the intended goals and objectives. The students and teacher participants indicated that they wanted increased opportunities to be involved in the plan and receive direct communication about the goals. The findings suggest, in the Glendale Public Schools, strategic planning and stakeholder involvement were essential in the roll-out and implementation of a 1:1 program to foster 21st century skills and DL.

**Ongoing strategic planning.** The administrators shared a variety of ways in which they engaged in strategic planning over the course of the ten years preceding the implementation of the 1:1. The administrators used phrases such as, “all the pieces have been put together for years,” “so many pieces have been strategically put into place,” “this was ten years in the making,” and “we’ve got ties to deeper learning” to describe their strategic planning work. They explained that during this period they built the infrastructure and budget needed to support the 1:1 program. Further, the administrators articulated that pre-implementation work required the support and inclusion of the town financial offices, the technology staff, the administrators, and the district technology committee.

After building the bandwidth, the administrators developed a five-year strategic technology plan that focused on teaching and learning. Stage one of the plan provided teachers with 1:1 devices and a series of professional development (PD) opportunities. Stage two of the plan supplied students in grades nine through twelve with devices. Stage three expanded 1:1 devices to students in grades six through eight. Stage four of the plan, scheduled to roll out next year, will increase device access to 1:1 in grades four through five and 3:1 in grades pre-kindergarten through three. As the district is entering the fourth and final stages of the plan, the administrators reported that they are revisiting the strategic planning process to build a plan for the next five years. They suggested that the next plan will be “goal oriented” and “include measurable objectives.”
District office administrators explained that the new strategic planning process would once again involve all stakeholders. Glendale recently released surveys from *Future Ready* (Future Ready Schools, 2015) to gain the input of administrators, teachers, students, school committee members, community organizations, and parents. Next, they will form a new technology committee to analyze the data and develop a five-year plan, inclusive of communication strategies. The administrators indicated that like the current plan, the new plan would include infrastructure, hardware and software, professional development, finance, teaching and learning goals, and communication strategies. District administrators reported that they missed several important communication strategies in the previous strategic plan, and have learned from that experience. For example, the district administration articulated that in the first strategic plan, “publicly it was never here’s where we started, here’s where we are, and this is what teaching and learning looks like.” The district administration agreed that they have reflected on these missing communication pieces and are evaluating how “to do a better job.” Thus, findings reveal that a focused 1:1 program cannot be successful in Glendale without a thoughtful strategic plan that is measurable and evaluated frequently.

**Transparent goal setting.** The administrators, students, and teachers all discussed the importance of transparent goal setting. The administrators explained that in the current iteration of the strategic plan, they outlined clear goals, which they published on the district website and in school and district handbooks. However, the administrators stressed that the goals lack measurability. For the next stages of the plan, they emphasized that “We have to ensure that classroom instruction is effective and that these are the tools that are increasing benefits.” As they enter the next strategic plan, all administrators stated that they would include transparent and measurable goals based on the *Future Ready Survey and Framework* (Future Ready Schools, 2015).
As such, the new strategic plan will include the following areas: curriculum, instruction, and assessment; use of time and space; technology, networks, and hardware, data and privacy; community partnerships; professional learning; budget and resources; and empowered, innovative leadership. Importantly, the previously listed categories are essential to any 1:1 strategic technology plan.

Like the administrators, the students and the teachers argued that the goals of the 1:1 program require transparency. As one teacher expressed, “I would have liked the district to have presented the standards to us.” In the opinion of the students and most teachers, the previous strategic plan created the infrastructure necessary to support the 1:1 program effectively. However, they argued that the plan was not transparent. Students stressed that because the district did not communicate clear goals, instruction from their teachers “lacked consistency, included “different expectations,” and is “challenging to navigate.”

All students and most teachers suggested that “the platform met their needs” and that the “infrastructure is reliable.” As such, the students and teachers emphasized that because the strategic plan provided the necessary infrastructure, many teachers engaged in 21st century teaching practices. For example, another teacher explained, “I wouldn’t say that the district has told us to do those things, but I would think, even people who have been reluctant initially have learned that this type of learning process we’re heading towards benefits students and teachers.” Hence, findings suggest that Glendale Public Schools require greater transparency of goals to realize instructional practices more consistently aligned with the goals of 1:1 to foster 21st century skill acquisition and DL.

**Implementation plans.** The administrators discussed the iterative nature of the 1:1 implementation plan. They revealed that as they moved through the five-year strategic technology
plan, they adjusted aspects of the implementation plan to meet the needs of students and teachers. For example, when they initially wrote the plan, the administrators indicated that 1:1 would begin in grades six and nine, adding two grades each year. Based on feedback from secondary teachers, the plan was adjusted, and implementation began in grades nine through twelve to provide equal access to technology and digital resources to mixed grade classes. As such, the administrators agreed that implementation plans require revisiting to ensure that the plan meets the intended educational goals without unintended consequences.

All the administrators, the students, and most of the teachers outside of the science department reported that the district 1:1 roll-out went smoothly. The teacher and the student participants described the first phase of implementation as “seamless” and “easy,” noting that the previous teacher laptop program and Chromebooks on a cart allowed them to “get their feet wet,” and get “a lot of experience.” Most study participants expressed that the additional support of the students on the Student Technology Assistance Team (STAT) allowed for a successful roll-out. All agreed that STAT is “super helpful,” “integral to the implementation,” “crucial in terms of the success,” and “invaluable in terms of what they’ve brought to the organization from a curricular standpoint.” Thus, the findings in Glendale revealed a clear implementation plan that provided structures and supports for students and teachers to comfortably transition to 21st century teaching and learning was critical to the 1:1 program and its objectives.

The 1:1 initiative, as rolled out and implemented in Glendale, ensured the purposeful integration of technology in content and pedagogy by providing multiple opportunities for two-way dialogue and significant communication amongst teachers, parents, and students. Repeatedly, all participant groups reported a lack of clear communication regarding the implementation and purpose of the 1:1 program. Administrators, students, and teachers expressed a
desire for ongoing opportunities for two-way dialog regarding the purpose of the 1:1 program and the expectations for integrating technology into content and pedagogy. The administrators acknowledged communication as an area of needed improvement. The students suggested that clear communication around the purposeful integration of technology into content and pedagogy would support parent understanding of the 1:1 program and teacher practice of consistent expectations. The teachers also emphasized their need for two-way communication to understand the expectations, as well as to have their voices heard regarding instructional barriers and opportunities. Thus, findings reveal that for the purposeful integration of technology to permeate Glendale, ongoing, two-way dialog across stakeholders is necessary.

**Communication with students and parents.** Students discussed the communication and messages that they received from the district. They described these communications as “sufficient,” noting that the decision to move to a 1:1 program was an “obvious one.” Further students reported that in providing ample opportunities for them to use Chromebooks on carts, the district afforded them hands-on opportunities to understand the purpose and function of the 1:1 program. The students also stressed that in engaging students as members of STAT, they were satisfied with the peer-to-peer communication about the 1:1 program and related supports.

The students emphasized dissatisfaction with district communication to parents and teachers regarding the purpose of the program. The students contended that the 1:1 program would improve if “parents understood,” “if all my teachers were on board,” and if the district set “consistent expectations.” They also stressed that their parents did not understand the educational benefits, nor did they have opportunities to have their questions and concerns answered by the district. The students explained that if the district engaged parents in more two-way discussion, they would
receive more parental support, especially if parents knew “that it’s just a different style of teaching, not less teaching.”

The students emphatically stated that they did not believe the district sufficiently communicated expectations about 1:1 technology integration with their teachers, noting that “teachers need to be brought up to speed,” but that many are “willing to try.” They emphasized that setting expectations “helps teachers just as much as it does students.” Because of the lack of two-way dialog with teachers, Glendale teachers did not implement consistent practices from classroom to classroom, making student learning difficult and confusing at times.

**Communication with building administrators and teachers.** Building administrators and teachers agreed with students that the district failed to communicate expectations for technology integration. Both groups of participants expressed a need for more opportunities to engage in discussions with the district administration regarding the purpose, expectations, and long-range plans of the 1:1 initiative. Many participants asked questions such as, “what’s the plan looking in the future;” “are people on our team investigating that;” and “what are the next steps?” To collaborate on answers to these and other questions, the teachers suggested that the district host “focus groups.” However, the teachers stressed that they did not want the district to communicate in the form of directives, and desired to be more involved in “collaborative leadership” decisions to understand their role in improving teaching and learning. For example, one teacher stated, “We have a lot of leaders, and we don’t need our principal to say, I want you to do something. It’s not about compliance, and then it goes to the union. It's about making our classes better.” As such, building administrators and teachers in Glendale require ongoing two-way dialog with district administration about the purpose, expectations, and long-range plans of 1:1 programs to foster 21st century skills acquisition and DL competencies.
Glendale’s 1:1 initiative fostered and supported teachers’ transformation of teaching and learning toward the acquisition of deeper learning and 21st century skills by the district providing them with a reliable infrastructure, technology, job-embedded professional learning, peer-to-peer collaboration opportunities, and recognition from their administrators. Providing technology is not sufficient to move teaching and learning into the 21st century. The administrator, student, and teacher participants contended that multiple layers of support systems for teachers are required including, reliable infrastructure and technology, job-embedded professional development (PD), time for collaboration, and collegial, constructive feedback. The administrators, students, and teachers acknowledge that without reliable infrastructure and technology, teachers would not disrupt their instructional routines to integrate technology. In addition, the students and the teachers argued that teachers require ongoing, embedded PD, such as a technology instructional coach, to transform their teaching. Although many of the teachers viewed the instructional technology coach as supportive PD, many also wished that the district provided coach was content specific.

The teachers and administrators stressed that when teachers have the time and structures to collaborate with, learn from, and observe their peers, instructional practices are more likely to shift to meet the objectives of purposeful technology integration. Several of the teachers and administrators shared a new openness to classroom visits, observations, and learning by modeling. The teachers reported that acknowledgment, along with constructive feedback aimed at increasing student acquisition of 21st century skills and DL competencies, would have a tremendous impact on instructional practices. Hence, findings support strategic planning, including systemic structures and supports, to drive 21st century teaching and learning in Glendale.
**Reliable infrastructure and technology.** As previously indicated, the administrators, students, and teachers agreed that without reliable infrastructure and technology, teachers would not transform their instructional practices for 21\textsuperscript{st} century skill acquisition or DL competencies. Most members of the focus group reported that the district provided students and teachers with the bandwidth and technologies needed to access resources, to integrate technology into instruction, and to apply 21\textsuperscript{st} century skills and DL competencies. Administrators and teachers also discussed the importance of evaluating the technology available and its alignment with the goals and objectives of the subject areas. For example, most teachers stated that their current laptops meet their instructional needs. However, teachers also expressed concern that if the district requires them to transition to Chromebooks in the future, the technology will limit their instruction. Teachers and administrators revealed that they are in the process of collaboratively defining replacement devices based on the needs of the department. Under the old technology plan, the district provided every teacher with the same device regardless of the subject area and grade-level needs. As noted earlier, the one-size fits all roll-out did not work well with some of the math and science programs and objectives. Thus, as the student participants in this study suggested, Glendale’s decisions about technology should “meet the objectives of the course.”

**Job-embedded professional learning.** To meet the needs of educators, the administrators, students, and teachers said that the district must provide ongoing and embedded professional development (PD). During the first year of the technology plan, the district began the process of professional learning through the provision of teacher laptops, workshops, conferences, classroom experimentation, unconferences, and outside courses. Workshops primarily entailed how-to lessons for teachers to understand the capability and functionality of their devices. Experimentation in classrooms largely consisted of teachers beginning to use their devices to present or share
information and resources. Unconferences included teacher-to-teacher collaboration through peer-taught sessions on technology integration. As such, the teachers indicated that “there are lots of opportunities” for PD, “the unconferences allow us to try,” “we have CPT days which are helpful,” and “we are ready to move to the next level in PD.”

Once the district provided students with devices, the teachers continued to engage in unconferences, while the district also provided access to a technology coach. The technology coach engaged in individual and small group lessons with teachers on technology integration and 21st century skills. Also, the technology coach observed teachers, gave feedback, and modeled lessons. Although initial teacher feedback about the coach was not consistently positive, now in year two of 1:1, teachers have begun to lament the loss of the coach. However, the teachers suggested that if replaced, the district should ensure that future technology coaches are content specific. In addition, the teachers reported that they are now better able to evaluate their PD needs as it relates to technology integration. As such, they expressed their readiness to move beyond the unconference model, and a desire to observe lessons in model classrooms based on their growth in understanding and application of 1:1.

In response to teacher requests, Glendale ramped up its PD model. In addition to workshops and unconferences, Glendale created structures for teachers to visit each other’s classrooms. The district also developed and implemented a micro-credential badging system. Through this system, teachers identify areas of personalized professional learning, engage in an in-depth study and application of their learning, and instruct their peers on their newly developed areas of expertise. As such, findings reveal that Gelndale’s provision of ample opportunities for personalized and job-embedded PD was vital to supporting the integration of technology into content and instruction.
**Sufficient time for peer-peer collaboration.** Closely related to job-embedded PD, the teachers and the administrators revealed the importance of time for teacher-teacher collaboration. Glendale organizes itself as a professional learning community (PLC), and teachers engage in ongoing collaboration to support student acquisition of essential knowledge and skills including DL. In fact, the teachers view themselves as major supports for one another in their professional learning communities (PLCs). As one teacher noted, “Just as the students are working on things and coordinating with the teachers, so are we as the teacher of teachers.” Another teacher shared that in the department PLC, “teachers realize technology is kind of like here, it’s here alright, we’ve got it, we’re doing alright. Now let’s really dig deep and use it, and really use it in the right fashion.” Although the district provides teachers with seven PD days, as well as regular collaborative planning time (CPT) and department time, teachers and administrators agreed that more time for collaboration is essential. To that end, building administrators and teachers are creating a new schedule that includes additional interdisciplinary and intradisciplinary CPT. Ultimately, in providing sufficient time for teachers to collaborate, Glendale’s administrators supported teachers’ efforts at continuous improvement of instruction in 1:1 environments.

**Recognition and feedback.** The administrators, students, and teachers all agreed that change is difficult. Many teachers struggle to transition from traditional teaching strategies to those that encompass 21st century skills and DL. Although teachers appreciated opportunities to experiment in their classrooms without negative feedback, they also indicated a desire to receive feedback and recognition from their administrators. For the past two years, teachers reported that building administrators provided limited feedback or recognition of their instructional shifts and technology integration. The teachers articulated that they are more likely to change their instructional practices when they receive acknowledgment and support for risk-taking, “as there
needs to be some sort of validation from our bosses that what we’re doing is unbelievable.” Now, with the drive to include regular walkthroughs as a component of the district’s teacher leadership program, building administrators visit classrooms on a more regular basis. Still, the teachers note that building administrators rarely provide feedback on 21st century skills and DL. The teachers emphasized the desire to experiment without negative feedback on their evaluations, while also seeking feedback to improve their instruction and celebrate their accomplishments. The teachers appreciated the building administrators’ recent efforts at recognizing technology integration and DL through posts on social media. As such, constructive feedback and recognition from Glendale’s administrators are essential factors that led to instructional change and supported 1:1 implementation to foster 21st century skills and DL.

In Glendale, the 1:1 initiative increased students’ engagement in and development of deeper learning competencies and 21st century skills in classrooms that purposefully integrate technology when teaching and learning expectations are in place and attended to. Examples of teacher lesson plans, student work samples, the program of studies, student handbooks, and focus group discussion offered evidence supporting increased student engagement and acquisition of DL competencies and 21st century skills in classes where teachers purposefully integrate technology. The administrators reported observations of increased student engagement, collaboration, communication, critical thinking, and real-world learning in classrooms where teachers integrated technology into their lessons and instruction. The administrators described what they observed as “collaboration and excitement,” “student engagement,” “real-world problem solving,” “students trying to figure it out on their own,” “less teacher lecturing in the front of the room,” “deeper learning,” and “responsibility.” The students shared that they are more engaged when their teachers incorporate technology effectively to meet the objectives of the lesson. In classes where their
teachers incorporated 21st century skills and DL, the students indicated they were, “more organized,” “able to move at their pace,” “more interested than just learning and memorizing information and stuff,” “motivated,” and “engaging [their] brain.” The teachers identified numerous lessons and showed examples of student work across curriculum areas illustrating increased engagement, self-directed learning, collaboration, communication, critical thinking, student ownership, and real-world learning. The teachers explained that when they integrate technology in a way that students see the larger connections and are encouraged to be self-directed, “the kids love it!” Thus, findings suggest that Glendale students are more engaged and have greater opportunities to acquire 21st century skills and DL competencies when their teachers integrate technology into instruction.

**Discussion of Findings in relationship to the Theoretical Framework**

The researcher used the Diffusion of Innovation (DoI) theoretical framework (Rogers, 2003) to examine the findings of this study. She chose this theoretical framework because of the alignment with the research design and purpose of the study. In identifying innovation, communication channels, social systems, and time as the core elements of DoI, Rogers’ (2003) framework provides important insight into the structures, relationships, and people involved in the transition to and implementation of 1:1 teaching and learning.

Before engaging in data collection, the researcher outlined the following propositions aligned to the DoI Theoretical Framework:

1. Organizations that intentionally diffuse innovations, paying close attention to social systems, time, and communication channels, will have a greater likelihood of achieving their intended objectives.
2. Teachers will purposefully integrate technology into content and pedagogy, if given sufficient communication, opportunities for collaboration, relevant support, and time.

3. Goal-oriented 1:1 solutions will foster increased innovation across educational organizations.

4. Students will experience increased engagement, the acquisition of 21st century skills, and greater opportunities for deeper learning in 1:1 environments where teachers purposefully integrate technology for deeper learning.

In the following section, the researcher will further discuss the DoI theoretical framework, along with the above propositions, and their connection to the results of this study.

**Transformation of teaching and learning in Glendale’s 1:1 environments occurred when the district paid close attention to the social systems, time, and communication channels.**

Rogers (2003) suggests that a visibly defined innovation is at the heart of any change. In fact, Rogers (2003) is clear that the innovation does not need to be new, just new to the individual or the organization. In the district presented in this case study, the administrators, students, and teachers identified the innovation as a 1:1 Chromebook initiative intended to increase student 21st century skills, DL, and prepare them for a “global world.”

**Communication channels.** Rogers (2003) contends that strong communication channels are a critical factor to the diffusion of innovation across any organization. Although the participants agreed that the district must improve its communication of expectations for teaching and learning, all participants identified the initiative and the intended purpose of 1:1 as fostering 21st century skills and DL.

As Rogers (2003) explains, communication channels are necessary to spread information and expectations regarding an innovation from the adopters to individuals within an organization
who are currently unaware of the innovation or the expectations for implementation. In this study, participant responses varied on the nature of the communication needed from the district. Although all the students indicated a need for direct expectation setting, the teachers did not. Some teachers agreed with the students and indicated, “there wasn’t a push from the top,” “I have a limited understanding of the expectations, and “I didn’t really feel prepared.” However, most teachers stated, “sometimes you don’t want a push from the top,” “I don’t believe in top-down,” “and, “I think one of the strengths of the implementation was there wasn’t some directive.”

Top down directives are not always effective. As Rogers (2003) contends, and Tang and Ang (2002) agree, when the communication channels involve peer-to-peer communication in support of the innovation, diffusion of that innovation is more likely to occur. The teachers and the administrators in this study also stressed that the peer-to-peer communication is critical. As one teacher suggested, “I can understand that people aren’t going to want to hear it from the administration, it is nice coming from the teachers.” Thus, findings reveal that although communication channels in Glendale need to be strengthened, the peer-to-peer communication channels supported the implementation of 1:1 for 21st century skills and DL.

**Social Systems.** As such, Rogers (2003) stresses that innovation occurs within the formal and informal social systems of an organization. Importantly, Rogers (2003) contends that these social systems either act as catalysts or barriers to the diffusion of innovation. Thus, it is critical that organizations cultivate and attend to the needs of the social systems (Rogers, 2003). Glendale established formal social systems called professional learning communities (PLCs). Within the PLCs, teachers collaborated, engaged in professional learning, and shared best practices about technology integration within their content areas. For the most part, the school organized the PLCs by departments.
According to the teachers, “We now have some big initiatives out there all coming together. One of them, and connecting and embracing all, is our professional learning community.” However, in focus group discussion smaller informal social systems also emerged. For example, within the science departments, a notable difference surfaced between the early adopters of the 1:1 initiative and teachers not yet ready to experiment with innovation through technology integration. As the focus group discussions carried on, some of the teachers who had not fully adopted began to open up to the idea of 1:1 to foster 21st century skills and DL within their smaller social systems. For example, one teacher exclaimed, “I was just getting emotional when I was talking about it. Can you teach me, please?” As such, findings suggest that it is critical that Glendale cultivate both the formal and the more informal social systems to effectively achieve the objectives of the 1:1 program.

**Time.** Regardless of the social system, all teacher participants called for more time for collaboration around the 1:1 initiative and teaching and learning in general. Rogers (2003) suggests that the element of time is more complicated than the mere provision of opportunity for preparation and collaboration. First, Rogers noted that leaders of innovation must consider “five main steps in the innovation-decision process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation” (2003, p. 20). Each of these elements takes time and overlap considerably with the elements of communication channels and social systems.

In the instance of 1:1 discussed in Glendale, although the administrators recognized the innovation ten years prior, they only recently made teachers aware of the program with the issuance of teacher laptops. At that point, the district communicated the 1:1 initiative and made the initial strategic plan more visible to all stakeholders. In providing teachers with opportunities for experimentation in their classes, ongoing PD, and research, Glendale hoped to persuade teachers to
transform teaching and learning to the 21st century. For some teachers, the experimentation strategy was very effective. Several teachers noted, “we all feel like we have the freedom to experiment, to try” and “the idea of playing with it and experimenting has been a big part of it, and then just collaborating with our colleagues on how we are using it.” However, because the district did not pass down directives regarding the initiative, teachers had the opportunity to, individually and within their social systems, to decide on their level of adoption.

Now in year two, many teachers implement the 1:1 program into their instruction daily, while others do not. For example, a small number of participants noted, “we don’t use them in class,” “we don’t use them a lot,” and “I don’t use technology to teach.” As more teachers implement and open their doors to others, and as they share examples of student work highlighting 21st century skills and DL, evidence and confirmation of the program are mounting. This evidence is encouraging reluctant teachers to implement 1:1. The rate of innovation adoption in this district occurred over three years and is still in its infancy. Hence, findings suggest that Glendale’s provision of teacher time and social support systems encouraged the current speed of innovation.

Glendale teachers integrate technology for 21st century skills and deeper learning competencies when provided sufficient communication, support, time, opportunities for collaboration, and peer evidence of effectiveness. As previously suggested, individuals are more likely to adopt and implement an innovation more quickly when they understand the purpose of the innovation, communicate with leaders and peers about that innovation, and collaborate with members of their social system on its implementation (Rogers, 2003). During the focus groups, administrators acknowledged some communication and expectation setting regarding technology integration to foster 21st century skills and DL. Students and teachers recognized the gaps in these channels of communication and expectation, yet uniformly identified the program and systems of
associated supports. Through collaboration with peers, PD, and experimentation in their classrooms leading to evidence of increased student engagement, 21st century skills, and DL, teachers realized the significance of integrating technology into instruction. Even teachers hesitant to integrate technology increased their curiosity and willingness to experiment to some degree when their peers in the focus groups shared best practices and examples of student work. However, all teachers and students suggested that the district must engage in more communication regarding expectations to ensure a consistent experience for students. Also, all teachers noted the need for additional opportunities for regular collaboration with their peers regarding technology integration and DL. Thus, findings revealed that departments in Glendale that regularly collaborated and set internal expectations for technology integration and DL adopted the innovation more quickly and evenly across teachers than departments that did not.

**Strategic planning and goal setting resulted in 1:1 systems coherence and transformation in Glendale because of its distributive leadership structures.** Based on Roger’s (2003) theory, the case presented in this study engaged in a more decentralized diffusion of innovation, affording significant opportunities for the Professional Learning Community (PLC) structures to define expectations. Using a decentralized approach presented both opportunities and barriers for Glendale, and limited the district’s ability to control the rate of diffusion or the re-definition of the innovation. Ultimately the PLCs and peer subgroups supported the diffusion of the 1:1 through formal and informal networks, experimentation, shared learning, and samples of student work and lessons leading to 21st century skills and DL. The administrators and the teachers indicated that they “embraced the PLC,” and that the district benefitted not from the “creation of PLC, but the implementation of PLC.” Since the administrators, students, and teachers all recognized the need to prepare students for a global economy with 21st century skills and DL
competencies, all members of the organization shared a problem of practice that required their unique attention. In fact, the teachers and the administrators all agreed, “it is the teams with the department,” that “are trying to figure out what is something that they can incorporate into their curriculum with regard to technology that’s consistent.” As such, in allowing for distributive leadership within and across the PLCs, Glendale steadily increased the diffusion of technology integration across its classrooms.

**Discussion of Findings in Relation to the Literature Review**

The literature presented in Chapter II focused on defining 21st century skills and DL through the examination of the integration of technology into content and pedagogy, the structures and supports that act as opportunities and barriers to the transformation of teaching and learning in 1:1 environments, and the role of the four elements of innovation in technology integration. In the section that follows, the researcher presents the findings of the study aligned with these four areas.

**21st century skills and deeper learning defined.** Research and literature clearly define 21st century skills as the communication, collaboration, critical thinking and creativity skills that students need for success in a global economy (Fullan & Langworthy, 2014; Goff, 2013; Jacobs, 2010; Partnership for 21st Century Education, 2009; Zhao, 2012). Similarly, the Hewlett Foundation’s (2014) definition of deeper learning (DL) competencies including communication, collaboration, critical thinking, academic mindsets including learning how to learn and self-directed learning, and academic content knowledge are also widely accepted. The participants in this case study discussed each of these 21st century skills and DL competencies as the instructional goals and outcomes of 1:1 technology integration.

The data collected through the focus groups and document reviews exposed significant substantiation of 21st century skills and DL in teacher instruction and student work products.
Evidence from the study surfaced pointing to technology infused opportunities for communication, collaboration, critical thinking, real-world learning, self-directed learning, student ownership of their learning, and rigorous academic content. Similarly, multiple studies indicated that 1:1 DL environments provide students ongoing opportunities for meaning making and self-directed learning (Fullan & Langworthy, 2014; Hatakka, Anderson & Grolund, 2013) through active collaboration, hands-on application, and real-world learning (Keengwe & Onchwari, 2011; Mishra, Koehler & Henriksen, 2011). Further, several studies revealed that students are more likely to collaborate, communicate, critically think, employ academic mindsets, transfer content knowledge, and demonstrate self-directed learning strategies when teachers provide technology-infused opportunities (AIR, 2014; Guha, Caspary, Stites, Padilla, Arshan, Park Tse, Astudillo, Black, & Adeleman, 2014). Thus, the practices outlined in the literature closely align to the evidence provided by the Glendale administrators, students, and teachers. In fact, the participants in this study identified these 21st century skills and DL competencies as the goals “where education is generally heading” for which they needed “to prepare [students] for what’s out there in the world,” “whether it is going to be college or career.”

**Technology integration into pedagogy and content.** As previously stated in this chapter, schools and districts across the country provide students access to 1:1 technologies at increasing rates. However, there is little evidence to suggest that many of these organizations focus on the purposeful integration of technology into content and pedagogy (Harris, Mishra & Koehler, 2009; Penuel, 2006). For this study, the purposeful integration of technology follows Dr. Rueben Puente du r a’s (2014) SAMR Model (substitution, augmentation, modification, and redefinition), where teachers use technology not only as a substitute practice or tool to augment assignments, but to also modify and redefine instruction in their classrooms. Further, this Case Study aligns with
Harris, Mishra and Koehler’s (2009) TPACK Model (technological, pedagogical, and content knowledge) where the purposeful integration of technology occurs at the intersection of technology, pedagogy, and content. Studies suggest that classrooms that adhere to models such as SAMR and TPACK transform teaching and learning meet the 21st century skills and DL competencies in a transformative way (Friday Institute, 2011; Harris et al., 2009; Jacobs, 2010; OECD, 2015a; Project Tomorrow, 2015; Puentendura, 2103; Topper & Lancaster, 2013).

Glendale participants revealed ways in which they integrated technology to meet the objectives of their core content while employing research-based instructional practices. The teachers included in this study provided lesson plans and student work samples incorporating rich-tasks aligned to rigorous content standards. Many of these tasks included complex, real-world problems requiring students to transfer skills and knowledge across content areas. For example, one task asked students to consider and provide solutions to over-fishing in George’s Bank from the perspective of environmentalists, fishers, and restauranteurs. Students researched, charted and graphed, debated the problem, and provided solutions from these varied perspectives. The anecdotes, lesson plans, and work samples support studies conducted by the American Institute for Research (AIR, 2014), Fullan and Langworthy (2014), Harris, Mishra and Koehler (2009) and the National Research Council (2012) which identified rich and complex tasks as one of the most critical pedagogical factors in supporting DL. In fact, all study participants acknowledge the school and district focus on a rigorous academic program, and rich-tasks are the norm. Hence, findings from the discussions and evidence across the focus groups and documents revealed that Glendale values the intersection of technology integration, instructional strategies, and academic content.

**Structures and supports that act as opportunities and barriers.** District and school leaders agree that any significant change or innovation involves structures and systems that have the
potential to serve as supports or barriers to implementation and wide-spread adoption. The literature suggests that teacher fears or uncertainty regarding self-efficacy with the integration of technology into pedagogy can act as barriers (Ertmer & Ottenbreit-Leftwich, 2010; Lee & Tsai, 2010). The teachers in this Case Study also voiced concern or uncertainty with the initial roll-out of 1:1 initiative, saying that they felt “fear,” “uncertain,” and “not sure if they were ready.” However, the administrators, students, and teacher participants agreed that most teachers “were willing to try.”

The literature also suggests that when leaders do not provide teachers with reliable technology and infrastructure, systems of support, collaborative work environments, and opportunities for professional learning, transformative change is unlikely (Jones, Harlow & Cowie, 2004; Keengwe & Onchwari, 2011). The administrators, students, and teachers in this Case Study indicated that without reliable infrastructure and technology, teachers would not transform their teaching through technology integration. Importantly, most of the study participants agreed that Glendale provided “a reliable infrastructure” and technology that “suited their needs.”

Additional studies reveal the importance of distributive leadership, clear expectations, and policies in the implementation of 1:1 and integration of technology across educational organizations (Huberman et al., 2014; Hung, Shu-Shing & Lim, 2012; Inan & Lowther, 2012; Kopcha, 2010; Keengwe & Onchwari, 2011). Repeatedly, throughout the focus group discussions, the Glendale participants also cited the importance of “teacher leaders,” “clear expectations,” and defined “responsible use policies.” In some instances, the teachers and students of Glendale cited the lack of expectations as barriers, and in other instances, teachers celebrated their flexibility and opportunities to define the 1:1 program with their teacher teams.
Studies also indicate that district and school provision of time and structures for teachers to collaboratively unpack the goals of technology integration, pedagogy, and content lead to consistent practices around 1:1 programs (Dunleavy, Dextert & Heinecket, 2007; Wilsey & Keengwe, 2012). The Glendale teachers and administrators highlighted the value of time and structures for teachers to collaborate and share pedagogical practices about technology integration within their content area. Next, Glendale administrators, students, and teachers acknowledged the importance of ongoing professional learning to meet the goals of technology integration to foster 21st century skills and DL. As such, the participants in this Case Study stressed that the purposeful integration of technology into content, “requires a lot of thought to unpack” by the department teams. Finally, the Glendale administrators and teachers celebrated the numerous opportunities for teacher collaboration, and insisted that even more time for collaboration would be helpful.

Additionally, studies found in the literature contend that teachers require opportunities to experiment, practice, and observe technology integration to develop self-efficacy (Ertmer & Ottenbreit-Leftwich, 2010; Lee & Tsai, 2010). The teacher participants in this Case Study also celebrated their “freedom to experiment,” and acknowledged that teachers in other districts “aren’t given that flexibility.” As part of this professional learning, Glendale teachers stated that they wanted to observe exemplary classrooms and receive feedback and acknowledgment from their administrators. The Glendale teachers and the administrators also pointed to new opportunities within the district for teachers to observe each other’s classrooms.

Finally, a few studies argued that an effective strategy includes student involvement in 1:1 structures and supports (Fullan & Langworthy, 2014). Like the literature, the administrators, the students, and the teachers in this Case Study all celebrated the students on the Student Technology Assistance Team (STAT), and their role in collaborative support of technology integration as a key
strategy for the implementation of 1:1. Thus, the practices and concerns of the administrators, students, and teachers in Glendale confirm and overlap the findings of the literature referenced in this section of chapter five.

The role of innovation, communication channels, time, and social systems. The diffusion of innovation surrounding 1:1 programs is difficult for districts and schools to achieve. The spread of innovation is challenging, and districts must decide if their best approach is through top-down directives or distributed leadership opportunities. This Case Study is grounded in Rogers’ (2003) Diffusion of Innovation (DoI) theoretical framework. Studies investigating technology integration using DoI as a framework suggest that technology integration often fails because leadership does not provide the necessary infrastructure or access to experts to spread the innovation (Stošić & Stošić, 2013). Additional studies reveal that the spread of the innovative teaching and learning model is dependent upon clear communication of the program goals and objectives to all stakeholders within the organization (Levin, Stephen, & Winkler, 2012). Moreover, studies indicate that when districts provide clear communication of their rationale, teachers are more likely to take the time to collaborate and implement the intended practices (Kebritchi, 2010). Finally, studies provide significant data to suggest that it is the social systems including administrators, students, and teachers within an organization that ultimately diffuse or block the spread of innovation (Frank, Zhao & Borman, 2004), including 1:1 programs. For example, a study conducted by Hung, Shu-Shing, and Lim (2012) argues that communities of practice rather than top-down directives are more effective at spreading innovative teaching and learning practices.

Ultimately, the administrators, students, and teachers participating in this Case Study agreed that Glendale did not implement the 1:1 initiative with many top-down directives. The district
administrators indicated that they expected the teacher teams, or PLCs, to collaborate and define best practices. Most participants articulated that to support the work of the teachers and building administrators; the district provided a “solid infrastructure,” “suitable platform,” and “reliable” technological devices. Also, the administrators and teachers outlined the numerous opportunities for professional learning and collaboration to build teacher efficacy around technology integration. The teachers and administrators repeatedly referenced the “unconferences,” technology coach, workshops, opportunities outside of the district, seven professional development days, and collaboration time as examples of opportunities for professional learning.

Most of Glendale participants agreed that teachers and students would have benefited from greater communications around the expectations for technology integration. In sum, as evidenced by differences in technology integration across departments and teachers, teachers play a major role in supporting or creating obstacles to the district-defined implementation of 1:1. As such, the Glendale district administrators, building administrators, and students acknowledged the need for clear and measurable goals and systems to support and monitor expectations. Thus, the findings from this Case Study align closely to the findings in the literature.

**Conclusion**

The purpose of this Case Study was to understand the perceptions of administrators, students, and teachers regarding the potential for technology integration to support student 21st century skill acquisition and deeper learning (DL) in a 1:1 environment in the Glendale Public Schools. Also, this study sought to understand the organizational structures and supports administrators, teachers, and students perceive as necessary to provide opportunities for students to achieve 21st century skills and DL competencies in a 1:1 environment. The research study used an instrumental single case study to understand the following research questions:
1. How has the district organized itself to support technology integration by teachers with the specific intent of fostering deeper learning and 21st century skills?

2. How do administrators, teachers, and students perceive the implementation of 1:1 and its impact on 21st century skills and deeper learning?

To achieve the goals of this study, the researcher selected one suburban district in its second year of 1:1 implementation. The researcher gathered data at the school and district level using focus group discussions with administrators, students, and teachers, as well as document analysis of websites, program of studies, student handbook, lesson plans, and student work samples. The researcher transcribed the data, engaged in a multi-step coding process, and developed resulting themes. Finally, the researcher analyzed the themes aligned with Rogers (2003) theoretical framework of DoI and relative to a review of the literature.

After a thorough analysis of the evidence and literature, four major findings emerged. First, Glendlae benefitted from engaging multiple stakeholder groups in the ongoing strategic planning, transparent goal setting, and implementation of their 1:1 plans. Secondly, in increasing multiple opportunities for two-way dialog and communication amongst teachers, parents, and students, Glendale can better ensure the purposeful integration of technology in content and pedagogy. Next, Glendale teachers transform teaching and learning through 1:1 programs to support student acquisition of DL and 21st century skills when district and building leadership provide them with reliable infrastructure and technology, job-embedded professional learning, sufficient time for peer-peer collaboration, and recognition from their administrators. Finally, Glendale students increase engagement and develop DL competencies and 21st century skills in classrooms that purposefully integrate technology and when teaching and learning expectations are in place and attended to. These major findings address the research questions outlined above.
Significance of the Study

This research study examined how administrators, students, and teachers perceive the implementation of 1:1 programs to foster 21st century skills and DL. In addition, this study analyzed the organizational supports and structures necessary to transform teaching and learning to meet 21st century skills and DL in 1:1 environments. The skills that students require for college and career have drastically changed (Koenig, 2011; OECD, 2013). Schools must prepare students with the necessary skills for success in the 21st century (Koenig, 2011; NRC, 2012; OECD, 2015a; Partnerships for 21st Century Skills, 2009; U. S. D.O.E Office of Educational Technology, 2010).

The development of these skills requires a shift in pedagogical strategies (Fullan & Langworthy, 2014; Groff, 2013; Jacobs, 2010; National Research Council, 2012; Stošić, & Stošić, 2013), access to reliable infrastructure, and robust systems of support. In this study, district and school administrators discussed these driving factors in their decision to shift to a 1:1 teaching and learning environment to foster 21st century skill acquisition and deeper learning competencies (DL). During the focus group discussions, Glendale administrators, students, and teachers revealed examples of 21st century teaching and learning and DL necessary to prepare students to be competitive globally. The participants agreed that it is no longer sufficient to prepare students to test well, as the application of DL competencies is critical for success in college and career. For example, several students and teachers referenced collaborative projects within the humanities courses where students investigated real-world problems and presented their findings using 21st century skills and DL competencies that required the transfer of knowledge and skills across content. One such project involved students conducting, analyzing, and presenting their findings from exit polling in their community during the Presidential election. To develop and implement rich tasks like the one outlined here, Glendale teachers and administrators noted the importance of
time and supports for collaboration, work within the professional learning communities (PLC), and ongoing professional development. Thus, the administrators, students, and teachers recognized that the provision of rich tasks and real-world learning opportunities in Glendale courses are essential for student success beyond standardized assessments.

All participants revealed that without assurances of reliable and robust infrastructure and technology, teachers would not shift their instruction to align with 21st century skills and DL competencies. Studies illustrate that learning organizations are often unable to provide such assurances, stalling or blocking the spread of innovative programs such as 1:1 (OECD, 2015a). The teachers and students involved in this study agreed that Glendale provided them with a robust infrastructure and technologies for teaching and learning. They also acknowledged opportunities for collaboration and ongoing professional learning. As such, it is because of supports related to infrastructure, time, professional learning, social systems, and communication that the diffusion of innovation resulting from the 1:1 program occurs in Glendale.

Even in the instance of Glendale, a district that provides many essential elements for the diffusion of the 1:1 initiative, almost all participants revealed communication and professional development as areas of needed improvement. The study revealed that Glendale administrators, students, and teachers understand the significance of ongoing communication, reflection, and measurement of the effectiveness of structures and systems of support for the spread of innovative teaching and learning to foster 21st century skills and DL.

Because the world of education and the expectations of our graduates are rapidly changing, this study may benefit any district or school considering the implementation of 1:1 programs. This study includes discussion of the systems of support and structures necessary to support 1:1 programs to foster 21st century skill acquisition and DL competencies. Further, this study examines
these systems and supports regarding the spread of innovative teaching and learning, as well as the impact on student learning from the perspectives of administrators, students, and teachers.

Examining these stakeholder perspectives was important, as, although there is some research on the impact of technology on student academic performance, there is limited research on the impact of 1:1 technology solutions on 21st century skill acquisition or deeper learning (OECD, 2015a).

Consistent themes and findings emerged across all three groups include in this study. Thus, it is likely that the strategies and findings associated with this Case Study may prove useful to similar organizations who are embarking on a 1:1 initiative and are seeking to foster 21st century skills and DL through the purposeful integration of technology.

**Recommendations**

After careful review of the research findings, the researcher offers the following recommendations for district and school leaders to consider:

1. Create and implement a long-range strategic plan that includes measurable objectives and systems of supports.

2. Connect teaching and learning goals to 21st century skills and deeper learning competencies.

3. Engage all stakeholders in two-way communication regarding the identified objectives, implementation plan, and perceived supports and barriers.

4. Outline clear expectations for technology integration with teachers and students as critical thought partners.

5. Provide innovative and ongoing professional learning opportunities for teachers aligned with the goals and objectives of the 1:1 program.
6. Develop systems and structures for teachers to engage in collaborative groups, such as professional learning communities.
7. Engage students as partners in support of technology hardware and integration.
8. Celebrate evidence of transformational teaching and learning, while providing constructive feedback.
9. Continue to study the impact of 1:1 on deeper learning and 21st century skills in future years of implementation to gain longitudinal understanding.

Create and implement a long-range strategic plan that includes measurable objectives and systems of supports. Each Glendale district and school leader discussed the importance of long-range planning to implement a 1:1 program to foster 21st century skills and deeper learning. As one administrator wondered, “I don’t know how other districts do it, I mean it was a long time process.” Moreover, the district administrators emphasized the importance of attaching measurable goals and objectives to that plan. As another administrator noted, “it goes back to our goals and what is is and why we are doing this” and then measuring by “matching back to the goals.” Finally, all participants reflected on the importance of including systems of supports to build and sustain the infrastructure, ensure reliable financing, and provide hardware and software that meets the educational objectives of the program. The administrators suggested, “without financing, you don’t have an infrastructure” and “if we don’t have that infrastructure, then it doesn’t matter.” Through the development and implementation of a strategic and measurable technology plan, Glendale positioned itself to transform teaching and learning using their 1:1 programs as the catalyst. The administrator, student, and teacher participants all stressed that if teachers don’t trust the infrastructure, they will not change their teaching. The evidence is clear, without a reliable and
robust infrastructure, teachers and students will not trust the system enough to change their practices.

**Connect teaching and learning goals to 21st century skills and deeper learning competencies.** The Glendale teachers and students clearly articulated a need to understand the goals of the 1:1 program better. At the same time, administrators, students, and teachers all agreed that the purpose of instruction in general, and technology integration specifically, should be to foster the acquisition of 21st century skills and deeper learning (DL) competencies. During the discussion, the participants used words such as “deeper learning,” “21st century skills,” “prepare for the future,” “apply learning,” “become self-directed,” and “competing globally not just within your town.” The administrators, students, and teachers provided numerous examples of lessons and work samples targeting 21st century skills and DL. Lessons and work samples included conducting exit polls, examining overfishing, coding, applying transcendentalism to today, connecting the experiences of historical figures to issues of race in modern times, investigating world economies, and creating for and presenting to authentic audiences to name a few. Glendale’s findings suggest that in clearly articulating the goals of 1:1 to include 21st century skills and DL, schools are more likely to see widespread application of these skills and competencies in practice. In providing opportunities for students to apply 21st century skills and DL competencies, schools and districts will prepare students to compete in a global economy.

**Engage all stakeholders in two-way communication regarding the identified objectives, implementation plan, and perceived supports and barriers.** Two-way communication is necessary to ensure that the stakeholders implement technology plans according to the intended objectives and that leaders can minimize all real and perceived barriers. The Glendale building administrators, students, the teacher participants all noted that the district did not provide sufficient
two-way communication. As a result, they suggested that implementation was inconsistent in their school. As one student said, “I think that one thing that would definitely help is if there was a little more consistent use across [classes.]” Also, they argued that principals, students, teachers, and possibly parents do not understand the purpose of the program or the available supports. Thus, the participants called for more opportunities, “where we had small focus groups” to engage in productive dialog to define and achieve the districts intended outcomes of the 1:1 initiative. Hence, Glendale’s findings suggest that districts that engage stakeholders in conversation allow for clarity of purpose, identification of needs, and provision of appropriate 1:1 solutions.

**Outline clear expectations for technology integration with teachers and students as critical thought partners.** Diffusion of innovation may be more likely in organizations that offer opportunities for shared leadership. Although the district organized itself as a professional learning community (PLC), and did not mandate top-down directives regarding the implementation of 1:1, many participants revealed a need for the district to set clear expectations. Repeatedly, the administrator and teacher participants discussed “embracing the PLC” for collaborative leadership and decision making. Glendale participants suggested that the stakeholders and district collaboratively establish the clear expectations.

Glendale did engage students in the implementation of 1:1 and the teaching and learning objectives. This involvement took the form of the Student Technology Assistance Team (STAT). All participants agreed that district use of STAT as a collaborative partner resulted in one of the “one of the most effective” support structures. Some participants referenced new opportunities for participatory collaboration in decision-making, such as the newly established Research Development and Innovation (RDI) team of teachers, administrators, and students. This team investigates innovative educational practices, engages in design-thinking to develop action plans
related to the innovations, and supports the implementation of the plans throughout the district. Glendale’s findings suggest that in engaging teachers and students as thought-partners, districts realize innovative approaches to teaching and learning.

**Provide innovative and ongoing professional learning opportunities for teachers aligned with the goals and objectives of the 1:1 program.** Teacher self-efficacy and empowerment are key drivers of any systemic school or district-wide innovation. As such, relevant and ongoing teacher professional learning opportunities are necessary. These opportunities must be job-embedded, differentiated, timely, collaborative, and innovative. Glendale provides regular opportunities for teachers to engage in individual and group professional learning using such strategies as coaching, unconferences, micro-credentialing, coursework, workshops, and classroom walkthroughs/observations. The district has a teacher leadership program they refer to as LEAPP (Lead, Educate, And, Promote the Profession). During the discussion groups, the teachers suggested that through LEAPP they “are starting the conversation,” and “changing from what is teaching to learning” to engage educators in a collaborative dialog about what they need as professionals and what students need as learners.

The administrators, students, and teachers involved in this Case Study agreed that even with all these opportunities for professional learning, teachers require additional and ongoing opportunities. The Glendale participants revealed that students from the STAT team have begun to engage teachers in just-in-time professional learning. The participants explained that collaboration between students and teachers to meet the objectives of 1:1 through STAT was unintended, yet extremely valuable to both parties. Thus, findings from Glendale reveal that without supports to build teacher-efficacy including collaboration with peers and students, the transformation of instructional practices using technology is unlikely.
Develop systems and structures for teachers to engage in collaborative groups, such as professional learning communities. Glendale organizes itself as professional learning communities (PLC) to support teacher collaboration and encourage distributive leadership. However, the district never directed the PLCs to collaborate around the effective implementation of technology into instruction. Even without such a directive, departmental teams regularly worked together during CPT and unconferences to share strategies to integrate technology to foster 21st century skill acquisition and DL. Most teacher participants provided examples of their peer-to-peer collaboration. Examples of this collaboration included learning from one another at unconferences, sharing practices within their departments, visiting one another’s classrooms, collaborating on and sharing lesson plans, and working together as a PLC. All teacher participants voiced a need for more collaborative planning time (CPT) and opportunities to work within and across departments with their peers. In understanding the time and supports Glendale provides for teacher collaboration, the evidence suggests teacher collaboration is one of the most important levers in driving change. Hence, district and school leaders must provide ample opportunities, schedules, and structures to support the collaboration of teachers for continuous improvement and the strategic implementation of 1:1 innovation objectives.

Engage students as partners in support of technology hardware and integration. Students have the potential to drive change in schools. The Glendale administrator, student, and teacher study participants emphatically agreed that the Student Technology Assistance Team (STAT) created the conditions necessary for the effective implementation of the 1:1 program. STAT supports not only the technology hardware and software but the actual integration of technology in teaching and learning. STAT members respectfully navigate teacher needs and provide timely supports. While STAT provides teachers with support, they engage in real-world
learning, thus improving their 21st century skill acquisition and DL competencies. As one teacher explained, “Kids, the STAT team, the people who get to do the STAT team as an internship, they’re learning and getting some real-world career experience, hand-on,” while “helping” the district, school, teachers, and students. Thus, schools that embark on a 1:1 initiative should develop and empower student support teams as partners in innovative teaching and learning practices and supports.

**Celebrate evidence of transformational teaching and learning, while providing constructive feedback.** Teachers and students benefit from constructive feedback and recognition of their accomplishments, in fact, the same could be said for all people. District and school leaders often forget to provide such encouragement. Glendale empowered teachers to experiment with technology and innovative teaching practices. However, school leaders did not always provide feedback or encouragement to teachers innovating in their practice. One teacher expressed concern that “some of the people up above don’t know how powerful it is,” and suggested that “there needs to be some sort of validation from our bosses.” District and school leaders must provide feedback and recognition to encourage the implementation, growth, and maintenance of any new initiative.

**Continue to study the impact of 1:1 on deeper learning and 21st century skills in future years of implementation to gain longitudinal understanding.** Although the district has been transitioning to 1:1 for several years, the high school was only in year two of student implementation at the start of this study. The middle school was only in year one and the upper elementary school had not transitioned. For the district to understand the implications of 1:1 across the district, they should engage in a longitudinal study that encompasses the perspectives of teachers, students, and parents across grade levels for an extended period of five to seven years.
The ongoing findings from such a study will allow the district to continue to make decisions about 1:1 that will inform practices related to deeper learning and 21st century skills.

Validity of the Study

To ensure that the results are of this study are valid, the researcher included participants that represented a broad range of organizational members. Prior to the discussions, the researcher informed the participants of the purpose of the study as well as reminded them of her positionality. She assured the participants of their anonymity and verified that their participation is in no way evaluative. Since this researcher does not evaluate teachers, students, or administrators, the participants reported comfort in freely responding. Further, the researcher clarified her biases and outlined the research propositions before the start of the study.

Since Rogers (2003) notes that innovation bias can occur in studies such as this, the researcher maintained reflective journals as part of the process. In addition, she engaged in member checking to ensure the accuracy of the data collected and transcribed. The researcher followed the researcher guides and questions to ensure the validity of the data collected. She selected participants to represent the larger population; however, all members of the core departments, administration, and student body had the opportunity to volunteer. Through the assistance of the high school secretary, the researcher scheduled focus group sessions to maximize participation. The researcher took the measures outlined in this section to ensure the validity of the data and the findings of the study.

Limitations of the Study

The findings of this study are limited to the boundaries of this research, namely the small suburban, New England school district, referred to as Glendale. This study included only one district and focused primarily on that district’s one high school, thus limiting the ability to transfer
the findings. In using a case study approach, it is important to note that the researcher included all district and building administrators, as well as eighteen students and seventeen teachers across content areas at the site. In involving a representative district and building sample, the researcher analyzed the 1:1 initiative from the perspectives of key stakeholder groups.

Since the study targeted the high school, the results of the study may not generalize to other grade levels or building configurations. Because this district and school fall within the boundaries of high-socioeconomic and high-performance status with low teacher and student mobility, the results may not generalize to districts or schools that differ in make-up or performance. As the district and school organize themselves as professional learning communities (PLCs), the results of the study may not transfer to organizations that lack similar organizational structures.

The researcher investigated strategies that allowed the school and district to diffuse instructional innovations and strategies associated with the 1:1 program. Also, the researcher reviewed systems of support established by the district to allow the 1:1 program to foster the acquisition of 21st century skills and deeper learning. These strategies are centered on the district and school involved in the case study, and are not representative of the entirety of strategies successful in meeting similar objectives.

Future Research Considerations

As this study investigates the structures and supports necessary to implement 1:1 technology integration to foster 21st century skills and DL in a small district, with only one high school, future studies should be conducted at additional sites with varying demographics. Further, studies should also be conducted in districts and schools not currently organized as professional learning communities. In expanding this study to other sites, researchers will have the opportunity to investigate if the findings generalize across settings.
Moreover, since the researcher conducted this study at a site in its second year of implementation, long-range findings are not possible. Thus, future research should consider longitudinal studies of 1:1 implementation at various intervals. In doing so, researchers will have the opportunity to understand if the systems of support identified by the participants change over the course of implementation.

Several students included in the focus groups referenced 21st century teaching and learning in courses outside of the core academic areas, as well as extracurricular areas. Many of the courses identified by students included those that require hands-on and experiential learning. As the researcher limited this study to core academic areas, teacher participants did not include those areas. Future research including non-core teachers and advisors of extra-curricular areas would be useful to understand the role of these areas in school and district efforts at diffusing 21st century skill and DL through the integration of technology.

As noted in recommendations, the district itself should engage in continued longitudinal research of 1:1 to foster 21st century skills and deeper learning. Glendale should investigate the perceptions of teachers, students, and administrators across grade levels and across time. Glendale should also investigate the next steps and strategies that teachers, students, and administrators consider necessary to continue to drive deeper learning and 21st century skills. As suggested by teachers within this study, ongoing focus groups could support the understanding of the 1:1 program’s impact on teaching and learning. In addition to understanding next steps and strategies moving forward, these focus groups could help answer several questions that emerged. First, how can the district support teachers who continue to struggle with the integration of technology into teaching and learning? Second, how can the district support students with a consistent set of expectations for teaching and learning without negatively impacting teacher autonomy and voice?
Third, how can the district continue to increase authentic learning opportunities for students? Finally, how can the district continue to increase self-directed learning and student voice? These questions will be critically important as technologies are continuously shifting, and Glendale will need to determine the impact of the shifts on teaching and on their goal of fostering deeper learning and 21st century skills.

Very little research has been conducted on the impact of 1:1 programs on 21st century skill acquisition and DL competencies. As such, additional studies across a wide array of schools and districts would provide further insights into the themes that emerged in this study. Also, additional studies may surface themes based on the unique attributes of these sites. Since little research has been conducted focusing on the impact of 1:1 technology integration on student acquisition of 21st century skills and DL, this study offers important findings that may inform future studies.

**Personal Comments**

I have had the opportunity to witness districts across the country implement 1:1 programs with the hope of transforming instruction. Time and time again, the focus of these plans has been on the shiny new laptops and increased screen time for students. Under the umbrella of blended learning or personalized learning, the expectation is that computer programs that self-pace and move students from skill to skill will increase student achievement. Time and time again, nothing ever changed in many of these places without layering in opportunities for students to critically think, collaborate, communicate, create, problem-solve, master core content, and understanding themselves as learners. As I observed schools and districts, while continuously researching best-practices, I remained convinced that equitable access to technology had the potential to transform teaching and learning if approached with a clear set of targets focused on 21st century skills and deeper learning (DL) competencies.
First and foremost, I believe that technology can unlock doors to experiences not otherwise possible, such as global collaboration and real-world learning. I also believe that it is these experiences that have the potential to ignite passions and empower students to become self-directed learners. As an educator and administrator, I have worked to ensure that students have equitable access to 1:1 devices. I have focused on access not to increase screen time, but to close gaps and barriers, while opening windows of opportunity.

As an administrator, I also recognize that not all educators are prepared for or have the self-efficacy to purposefully integrate technology to provide opportunities for DL. Thus, I found it necessary to provide teachers and administrators the opportunities to build their technology skills in a safe, collaborative environment. I encouraged experimentation without fear of negative evaluation. I attempted to remove barriers and engage in dialog to answer the questions that would drive innovative teaching and learning practices.

Throughout these efforts, I often reflected on the impact of my efforts. I wondered how administrators, teachers, and students perceived the structures and systems of supports. I was curious about the strategies these stakeholders would find effective in moving toward 21st century objectives. I wanted to understand if the structures and systems resulted in DL. Moreover, I wanted to understand how district leaders could organize themselves and systems of supports to foster 21st century skills and DL. The research design of this study allowed me to answer these questions within the context of a participant-researcher.

Because of my work with this study, including the data collection, analysis, and formulation of findings, I have developed a better understanding of my research questions. At the start of the study, I expected to find very different perceptions across the three participant groups. I was surprised to discover alignment and consistency in their thinking. I realized that the diffusion of 1:1
to foster 21st century skills and DL requires many of the same supports and strategies across the stakeholder groups. The administrators, students, and teachers all shared their desire for DL, while acknowledging holes in their systems of support. The diffusion of innovative teaching and learning requires measurable strategic plans, clear communication of desired outcomes, transparent expectations, robust infrastructure and technology, ongoing professional learning, opportunities for collaboration, recognition, feedback, and time. Regardless of the stakeholder group, participants in this study consistently pointed to these strategies and systems of support.

As a scholar-practitioner, I connected the literature, theoretical framework, and research back to my role as a district administrator. The findings of this study have impacted my thinking and my practice. I have a greater understanding of the experiences and perceptions of teachers and students, as well as a better insight into their ongoing needs. I encourage other leaders embarking on 1:1 initiatives to use this research to inform their decisions and strategies. Most importantly, I encourage all educational leaders to focus on 21st century skills and deeper learning to prepare for a world that does not yet exist.
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Appendix A

Administrator Focus Group Protocol

Institution: _____________________________________________________

Participants (Title and Name): ______________________________________

Researcher: _____________________________________________________

Date: ______________________

Location of Focus Group: ____________________________________

Previously attained background information

Research question: The overarching research question for this study is how teachers, students, and administrators perceive the implementation of 1:1, and its impact on 21st century skill acquisition and deeper learning.

Part I: Introductory Question Objectives (5-7 minutes), to begin after signed informed consent is collected

Introductory Protocol

I want to thank you in advance for your time and your willingness to participate in this focus group, I am a doctoral student at Northeastern University and this focus group is part of the requirements for my doctoral dissertation. I have selected you to speak with me today because I identified as someone who has a great deal to share about the experience of 1:1 in the district. My research project focuses on the experience of administrators, teachers, and students with a particular interest in understanding how these groups describe their experiences with 1:1. Through this study, I hope to gain more insight into your experience with 1:1, especially how it relates to 21st skills and related deeper learning competencies. I hope that this will allow me to identify ways in which we can better support teachers, students and administrators involved in 1:1 programs.

Because your responses are important and I want to make sure to capture everything you say, I would like to audio tape our conversation today. Do I have your permission to record this focus group discussion?

Thank You. I am turning on the recorder now.

I will also be taking written notes during the focus group.

I can assure you that all responses will remain confidential and I will only use a pseudonym when quoting from the transcripts. As such, it is important that you not share the responses from other members of today’s focus group with people outside of this room. I will be the only ones privy to the tapes, which I will eventually destroy after they are transcribed. To meet our human subjects’
requirements at the university, you must sign the form I have with me. To summarize what is in this document, it states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm. Do you have any questions about the focus group process or this form?

We have planned this focus group meeting to last about 60 minutes. During this time, I have several questions that I would like to cover. If, at any time, you are uncomfortable with a question or need me to re-phrase, please feel free to let me know.

First, I will begin asking you questions about your role at the school.

1. What is your administrative/teaching role?
2. How long have you been in this role?
3. What subject(s) do/did you teach [prior to becoming an administrator]?
4. How long have you been a teacher/an administrator for this school/district?

I will now ask you some questions about the implementation of 1:1, the structure and supports in place, the communication about 1:1, the professional development opportunities, the time allotted for implementation and the role of the district’ social system. I would like to hear about your experience in your own words. Your responses may include both academic and non-academic elements as appropriate.

5. In your own words, can you describe the district’s 1:1 innovation initiative?
6. Why do you think the district moved to 1:1? In other words, what was the overarching purpose?
7. Can you describe the rollout and implementation of the 1:1 initiative and your thoughts on its effectiveness?
8. What are the systems of support that are most useful to you in the transition to 1:1?
9. What does the 1:1 initiatives mean for administrators? What has changed and what is the impact on your practices?
10. What, if anything has changed in teaching and learning because of the 1:1 technology integration initiative, if any?
11. Are you will to share some stories, work samples, and/or documents that exemplify what has occurred in teaching and learning as a result of 1:1?
12. Do you have any additional questions or comments that you would like to share?

During the discussion, the researcher is interested in the below look-fors:

- Description of the district’s implementation of 1:1 including why and how the program was rolled out
- The channels of communication leading up to and during the implementation
- The perception of the participants surrounding the program objectives, and the district’s success in achieving
- The structures and systems of support in place that have helped with the 1:1
- The barriers, if any, that are in the way of a successful implementation
- The role of the social systems of the school in influencing the implementation
- The requirements for 1:1 use in the school and how the requirements were established
- Shifts in pedagogical practices because of the 1:1 solution?
• The frequency, types, and effectiveness of professional development opportunities the district or school has afford you
• Perceived benefits and/or downsides of 1:1?
• How participants feel about the integration of technology in teaching and learning
• Role of 1:1 in fostering and supporting the development of students’ 21st century skills and deeper learning?
• Examples of
  - Communication
  - Collaboration
  - Critical Thinking
  - Creativity
  - Global Citizenship
  - Cognitive Factors
    - Critical Thinking
    - Content Mastery
  - Interpersonal Factors
    - Collaboration
    - Communication
  - Intrapersonal Factors
    - Academic Mindsets
    - Learning How to Learn

Thank you for your participation today and for being willing to answer my questions. I will review our focus group discussions. If I have any follow-up questions or need clarification, may I reach out to you? If you have any further questions, please reach out to me. If you have work samples or lessons that you are willing to share, please complete the lesson plan/work sample form and return to me.

Thank you for your participation in this important study. I am ending the recording now.
Appendix B
Student Focus Group Protocol

Institution: _____________________________________________________

Participants (Title and Name): ______________________________________

Researcher: ___________________________________________________________________

Date: _____________________________________

Location of Focus Group: ____________________________________________

Previously attained background information

Research question: The overarching research question for this study is how teachers, students, and administrators perceive the implementation of 1:1, and its impact on 21st century skill acquisition and deeper learning.

Part I: Introductory Question Objectives (5-7 minutes), to begin after signed informed consent is collected

Introductory Protocol

I want to thank you in advance for your time and your willingness to participate in this focus group, I am a doctoral student at Northeastern University and this focus group is part of the requirements for my doctoral dissertation. I have selected you to speak with me today because I identified as someone who has a great deal to share about the experience of 1:1 in the district. My research project focuses on the experience of administrators, teachers, and students with a particular interest in understanding how these groups describe their experiences with 1:1. Through this study, I hope to gain more insight into your experience with 1:1, especially how it relates to 21st skills and related deeper learning competencies. I hope that this will allow me to identify ways in which we can better support teachers, students and administrators involved in 1:1 programs.

Because your responses are important and I want to make sure to capture everything you say, I would like to audio tape our conversation today. Do I have your permission to record this focus group discussion?

Thank You. I am turning on the recording now.
I will also be taking written notes during the focus group discussion.

I can assure you that all responses will remain confidential and I will only use a pseudonym when quoting from the transcripts. As such, it is important that you not share the responses from other members of today’s focus group with people outside of this room. I will be the only ones privy to the tapes, which I will eventually destroy after they are transcribed. To meet our human subjects’ requirements at the university, you must sign the form I have with me. To summarize what is in this document, it states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm. Do you have any questions about the focus group process or this form?

We have planned this meeting to last about 60-75 minutes. During this time, I have several questions that I would like to cover. If, at any time, you are uncomfortable with a question or need me to re-phrase, please feel free to let me know.

**First, I will begin asking you questions about you.**

1. What grade are you in?
2. How long have you been a student in the district?
3. How long have you had access to a 1:1 device in the school?

**I will now ask you some questions about the implementation of 1:1. I would like to hear about your experience in your own words. Your responses may include both academic and non-academic elements as appropriate.**

4. In your own words, can you describe the district’s 1:1 innovation initiative?
5. Why do you think the district moved to 1:1? In other words, what was the overarching purpose?
6. Can you describe the rollout and implementation of the 1:1 initiative and your thoughts on its effectiveness?
7. What are the systems of support that are most useful to you in the transition to 1:1?
8. What does the 1:1 initiatives mean for students? What has changed and what is the impact on your learning?
9. What, if anything has changed in teaching and learning as a result of the 1:1 technology integration initiative, if any?
10. Are you will to share some stories, work samples, and/or documents that exemplify what has occurred in teaching and learning as a result of 1:1?
11. Do you have any additional comments/questions that you would like to share?

During the discussion, the researcher is interested in the below look-fors:

- Description of the district’s implementation of 1:1 including why and how the program was rolled out
- The channels of communication leading up to and during the implementation, including communication with families, students, teachers and administrators
• The perception of the participants surrounding the program objectives, and the district’s success in achieving
• The structures and systems of support in place that have helped with the 1:1
• The barriers, if any, that are in the way of a successful implementation
• The role of the social systems of the school in influencing the implementation
• The requirements for 1:1 use in the school and how the requirements were established
• Shifts in pedagogical practices because of the 1:1 solution?
• The frequency, types, and effectiveness of professional development opportunities the district or school has afford you
• Perceived benefits and/or downsides of 1:1?
• How participants feel about the integration of technology in teaching and learning
• Role of 1:1 in fostering and supporting the development of students’ 21st century skills and deeper learning?
• Examples of, and how the following, impacted teaching and learning:
  - Communication
  - Collaboration
  - Critical Thinking
  - Creativity
  - Global Citizenship
  - Cognitive Factors
    - Critical Thinking
    - Content Mastery
  - Interpersonal Factors
    - Collaboration
    - Communication
  - Intrapersonal Factors
    - Academic Mindsets
    - Learning How to Learn

Thank you for your participation today and for being willing to answer my questions. I will review our focus group discussions. If I have any follow-up questions or need clarification, may I reach out to you? If you have any further questions, please reach out to me. If you have work samples or lessons that you are willing to share, please complete the lesson plan/work sample form and return to me with your parent/guardian’s signature if you are under 18.

Thank you for your participation in this important study. I am ending the recording now.
Appendix C
Teacher Focus Group Protocol

Institution: _____________________________________________________

Participants (Title and Name): ______________________________________

Researchers: _____________________________________________________

Date: _____________________________________

Location of Focus Group: ____________________________________

Previously attained background information

Research question: The overarching research question for this study is how teachers, students, and administrators perceive the implementation of 1:1, and its impact on 21st century skill acquisition and deeper learning.

Part I: Introductory Question Objectives (5-7 minutes), to begin after signed informed consent is collected

Introductory Protocol
I want to thank you in advance for your time and your willingness to participate in this focus group, I am a doctoral student at Northeastern University and this focus group is part of the requirements for my doctoral dissertation. I have selected you to speak with me today because I identified as someone who has a great deal to share about the experience of 1:1 in the district. My research project focuses on the experience of administrators, teachers, and students with a particular interest in understanding how these groups describe their experiences with 1:1. Through this study, I hope to gain more insight into your experience with 1:1, especially how it relates to 21st skills and related deeper learning competencies. I hope that this will allow me to identify ways in which we can better support teachers, students and administrators involved in 1:1 programs.

Because your responses are important and I want to make sure to capture everything you say, I would like to audio tape our conversation today. Do I have your permission to record this discussion?
Thank You. I am turning on the recording now.

I will also be taking written notes during the focus group.
I can assure you that all responses will remain confidential and I will only use a pseudonym when quoting from the transcripts. As such, it is important that you not share the responses from other members of today’s focus group with people outside of this room. I will be the only ones privy to the tapes, which I will eventually destroy after they are transcribed. To meet our human subjects’ requirements at the university, you must sign the form I have with me. To summarize what is in this document, it states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm. Do you have any questions about the focus group process or this form?

We have planned this focus group to last about 60-75 minutes. During this time, I have several questions that I would like to cover. If, at any time, you are uncomfortable with a question or need me to re-phrase, please feel free to let me know.

First, I will begin asking you questions about your role at the school.

1. What course(s) you teach? What grade or grades do you teach?
2. How long have you been teaching?
3. Why did you choose to teach at this particular school?
4. How long have you been teaching at this school?

I will now ask you some questions about the implementation of 1:1, the structure and supports in place, the communication about 1:1, the professional development opportunities, the time allotted for implementation and the role of the district’s social system. I would like to hear about your experience in your own words. Your responses may include both academic and non-academic elements as appropriate.

5. In your own words, can you describe the district’s 1:1 innovation initiative?
6. Why do you think the district moved to 1:1? In other words, what was the overarching purpose?
7. Can you describe the rollout and implementation of the 1:1 initiative and your thoughts on its effectiveness?
8. What are the systems of support that are most useful to you in the transition to 1:1?
9. What does the 1:1 initiatives mean for students? What has changed and what is the impact on your teaching and students’ learning?
10. What, if anything has changed in teaching and learning because of the 1:1 technology integration initiative, if any?
11. Are you willing to share some stories, work samples, and/or documents that exemplify what has occurred in teaching and learning as a result of 1:1?
12. Do you have any additional comments/questions that you would like to share?

During the focus group, the researcher is interested in the below look-fors:

- Description of the district’s implementation of 1:1 including why and how the program was rolled out
The channels of communication leading up to and during the implementation, including communication with families, students, teachers and administrators
The perception of the participants surrounding the program objectives, and the district’s success in achieving
The structures and systems of support in place that have helped with the 1:1
The barriers, if any, that are in the way of a successful implementation
The role of the social systems of the school in influencing the implementation
The requirements for 1:1 use in the school and how the requirements were established
Shifts in pedagogical practices because of the 1:1 solution?
The frequency, types, and effectiveness of professional development opportunities the district or school has afford you
Perceived benefits and/or downsides of 1:1?
How participants feel about the integration of technology in teaching and learning
Role of 1:1 in fostering and supporting the development of students’ 21st century skills and deeper learning?
Examples of, and how the following, impacted teaching and learning:
- Communication
- Collaboration
- Critical Thinking
- Creativity
- Global Citizenship
- Cognitive Factors
  - Critical Thinking
  - Content Mastery
- Interpersonal Factors
  - Collaboration
  - Communication
- Intrapersonal Factors
  - Academic Mindsets
  - Learning How to Learn

Thank you for your participation today and for being willing to answer my questions. I will review our focus group responses. If I have any follow-up questions or need clarification, may I reach out to you? If you have any further questions, please reach out to me.

Thank you for your participation in this important study. I am ending the recording now.