The Impact of a One to One Laptop Program on the Self-Efficacy of Nine Middle School Students with Specific Learning Disabilities

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THE IMPACT OF A ONE TO ONE LAPTOP PROGRAM ON THE
SELF-EFFICACY OF NINE MIDDLE SCHOOL STUDENTS WITH SPECIFIC
LEARNING DISABILITIES

Dissertation
by
ADAM STEINER

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THE IMPACT OF A ONE TO ONE LAPTOP PROGRAM

ABSTRACT

The Impact of a One to One Laptop Program on the Self-Efficacy of
Nine Middle School Students with Specific Learning Disabilities

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A significant body of research has examined the impact of technology on pedagogy (Cuban, 1999; Enyedy, 2014), student achievement (Schachter, 1999; Cheung & Slavin, 2013, OECD, 2015), and equity (Reich, Murnane & Willett, 2012; Van Deursen & Van Dijk, 2011) with both positive and negative results within each domain. Research has also examined the impact of technology on the success of students with disabilities in various domains (Corn, Tagsold, & Argueta, 2012; Hargreaves & Braun, 2012; Harris & Smith, 2004; Penuel, 2006). However, no research has assessed the impact of one to one technology, in particular, on the self-efficacy of students with specific learning disabilities in educational settings.

This dissertation examined the experience of nine middle school students with specific learning disabilities in the first year of a one to one laptop program. Among the guiding questions for this research was the following: What characteristics of 1:1 programs present particular challenges or opportunities for students with learning disabilities? A series of interviews with students, parents, and teachers, as well as pre and post-surveys gauging student self-efficacy, were organized within the frame of activity theory and analyzed using a case-study narrative approach.
Findings from the research suggest the presence of several critical conditions that support student self-efficacy in this one to one program. These critical conditions include the presence of a culture of collaboration, putting the needs of teachers first in terms of comfort with technology, providing a system of professional development for both students and teachers, encouraging the philosophy of a growth mindset in relation to technology, and adopting a Universal Design for Learning (UDL) framework as a model for curriculum design that emphasizes equity through flexibility.
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CHAPTER 1: Introduction

Technology is everywhere in education and at the same time it is nowhere. It is everywhere in terms of financial investment in networks, devices, and software, professional development for teachers and administrators, and visions of school improvement. At the same time, it is nowhere when one looks for significant, consistent changes in classroom practice, teacher strategy, or in student achievement. This disconnect between the stuff of technology and the practice of technology is at least partially due to the inability of pedagogy to keep up with the pace of technological change. However, it is also because we do not focus enough on how students perceive technology and its impact on their learning.

There is no doubt that leaders are making a financial commitment in response to the growing interest in technology’s value to schools and classrooms. Global investment in digital hardware and software is growing dramatically. Overall educational technology spending is projected to reach $252 billion by 2020 (Global, 2016). More specifically, spending on educational technology hardware alone rose to $15 billion in 2015 (Chang, 2016) and spending on learning management systems (LMS) was estimated to surpass $2.5 billion in 2014 (Mallon, Wang-Audia, & Tauber, 2014). This emphasis on technology spending is only expected to grow – in 2016; nearly half of US school systems expected to spend more on technology hardware in the following year including 58% looking closely at one to one computing options (Ednet Insight, 2015).

At the same time, there is some question as to the most appropriate way to measure outcomes of this investment. Some point to the mixed, at best, evidence of the benefits of educational technology in terms of pedagogy (Cuban, 1999; Enyedy, 2014). Others argue that
there is some limited evidence of a benefit for student achievement (Schachter, 1999; Cheung & Slavin, 2013), and school equity (Reich, Murnane & Willett, 2012; Van Deursen & Van Dijk, 2011). Another group argues that significant use of technology at school may even have a negative impact on student achievement (OECD, 2015), in part due to issues with distractibility (Beland & Murphy, 2016). In addition, a recent meta-analysis of childhood technology use suggests that technology has the potential to lead to weaker executive functioning skills, higher obesity and depression, in particular among younger children (Chassiakos, 2016).

However, within this broad collection of research, one important yet minimally addressed account of the value of technology remains. Student self-efficacy (Bandura, 1977), the student’s belief that he or she is capable of performing in such a way as to produce a desired outcome, is the focus of this research. Self-efficacy for students consists of an interplay of a number of factors including social abilities, academic achievement, self-regulation, meeting expectations of parents and peers, and self-assertive capability (Bandura, 1993). Certainly, there is clear evidence of the importance of self-efficacy in producing positive outcomes for students, in particular, in relation to technology confidence (Kinzie, 1991; DeTure, 2004). For example, student self-efficacy is correlated with confidence in their self-regulation, which produces benefits for student achievement (Zimmerman & Martinez-Pons, 1990; Zimmerman, 1990; Pajares, 1996). In addition, strong self-efficacy helps to maximize student engagement (Linnenbrink, 2003).

In addition, individualized instruction through technology has evolved into a popular component of modern schooling. The United States government has been one of the greatest champions of this vision of school technology, arguing that workplace success in the 21\textsuperscript{st} century
relies on the interactive and individualized instruction that potentially comes with a technology-rich learning environment (Calmes & Wyatt, 2013). In addition, supporters of the expanded use of technology in schools emphasize the transformative potential of technology to create a model of “distributed learning” (Dede, 1996) in which new forms of pedagogy, enriched by technology, reduce the importance of traditional synchronous classrooms. Within this group, some argue that a new mode of school leadership is necessary that focuses on creating a school technology culture that is “transparent, relevant, meaningful, engaging, and inspiring” (Sheninger, 2014, p. xxii). In addition to this change leadership, Michael Fullan also points to “new pedagogies” or ways of teaching that leverage technology to connect teachers and students (Fullan & Langworthy, 2013).

Others, including Harvard Business School professor Clayton Christensen, argue that educational technology has the potential to serve as a disruptive innovation in schools by providing a platform for individualized instruction that maximizes intrinsic motivation (Christensen, 2008). Christensen contends that digital instruction consisting of individualized online courses is a superior alternative to traditional schools, which merely incorporate technology into the traditional factory model of education (Christensen, 2008). For Christensen, most schools’ use of technology qualifies as a sustaining innovation, a change in practice that does not challenge the fundamental nature of schooling, but supplements the largely teacher-centered and standards-driven mode of instruction. However, sustaining innovations are not failures according to Christensen. They “tend to maintain a rate of improvement; that is, they give customers, something more or better in the attributes they already value” (Brown & Christensen, 1995). However, he argues a truly disruptive use of technology in education will
emerge separately from existing schools and utilize technology as a platform for individualized
online instruction that is personalized, based on student need and interest (Christensen, 2008).
Criticism of this disruptive innovation model point to a history of rejected innovations in
schools. They argue that what is needed is a convergence of innovation and improvement from
within that enjoys the benefits of the integration of technology while also recognizing its
drawbacks (Hargreaves & Shirley, 2012).

This balanced approach argues that educational technology’s true value lies in its ability
to work alongside a skilled teacher as it “reinforces, deepens, and extends students’ learning
opportunities (Barber, Donnelly, & Rizvi, 2012, p. 56). One popular model of this philosophy is
“blended learning,” which has become a hotbed of debate in relation to technology use in
schools. The blended model consists of a mix of traditional and online instruction in order to find
a balance of platforms and has the potential to represent either a sustaining or a disruptive
innovation in its four forms: rotational, flex, ala carte, and enriched virtual (Christensen, Horn, &
Staker, 2013). In the rotational model, the least transformational of the four, individual teachers
mix online activities into traditional classroom activities. Because rotational blended learning
does not necessarily upset the teacher-centered classroom, Christensen would classify it as a
sustaining innovation. The other three models have greater disruptive potential. Flex blended
learning is supervised by a teacher on site, but all learning occurs online and students move in a
self-directed fashion. Ala carte blended learning is completely online and led by a teacher who
only interacts with the student digitally. In an enriched virtual classroom, students have some
initial face to face sessions, but primarily learn in an online environment. In these three blended
learning models, the teacher acts as students’ guide as students navigate a personalized and intrinsically motivating digital environment (et. al., 2013).

All of the blended learning models depend on student access to a reliable digital device such as a laptop or tablet. In order to insure equitable and reliable access, some schools have turned to the 1:1 laptop program, in which each student is provided a common digital device that is used throughout the school day and often brought home with students in order to complete digital work at home as well (Penuel, 2006). One to one programs have the potential to not only mitigate the challenge of having multiple devices in one classroom, but also offer a more consistent experience for students than relying on shared equipment (Bebell & Kay, 2010). However, some argue that this potential has gone largely unrealized because schools do not yet know how to capitalize on technology. One OECD study, “Students, Computers, and Learning: Making the Connection” suggests that efforts to support educational equity must precede an appreciable impact of technology on student achievement (OECD, 2015).

Based on the promise that one to one offers, several states including Maine and California (Spires, Oliver, & Corn, 2011) and countries such as Spain, Sweden, and Norway have implemented large-scale one to one initiatives (European Schoolnet, 2013). The popularity of these programs is growing significantly due to the widespread availability of wireless networks and the unprecedented power and distribution of mobile devices. Low cost technology now has the potential to offer each student a device that provides access to the Internet and a variety of digital tools in the classroom and at home (Penuel, 2006).

One to one programs, more than other types of technology implementation, have the potential to produce benefits for student learning. For example, studies have shown that these
programs support the academic performance of students, in particular for literacy skills (Bebell & O’Dwyer, 2010; Sauers & McLeod, 2012). Other studies suggest that laptop programs enhance student autonomy, collaboration, and problem solving skills (Zheng et. al., 2016). Further, Rosen & Beck-Hill (2012) examined the impact of a one to one program on 476 4th and 5th grade students in the Dallas area and found significant improvements in math and reading achievement in comparison to a control group without one to one access. Nonetheless, research on one to one technology is still in an emergent stage.

One key domain of one to one technology research relates to outcomes for students with special educational status. Indeed, students with special educational needs may have the most to gain from technology that looks and functions the same for every student and can be adjusted based on individual need and preference. This universal access can help to alleviate potential stigma from the use of specialized or assistive technology that calls attention to itself while supporting learning (Parette & Scherer, 2004). In some cases, this stigma can even lead to technology abandonment among students who would have otherwise benefited from using the technology (Hargreaves & Braun, 2012). Further, laptops may enable some students with disabilities to produce higher quality work (Harris & Smith, 2004) while also increasing the confidence of students with special educational needs (Corn, Tagsold, & Argueta, 2012).

Students with specific learning disabilities (SLD) are generally defined as those who fail to respond to well-implemented evidence-based instructional practices in one or more core academic areas challenges (Jackson & Karger, 2015). Given these specific, discrete challenges, students with SLD are particularly well-suited to benefit from one to one technology. This is true for a number of reasons. First, modern digital technology serves two primary purposes: to
compensate for a particular weakness and to capitalize on a strength, which matches well with the variation in strengths and limitations in students with SLD (Lewis, 1998). In addition, students with SLD often have academic trouble in one or more discrete areas such as reading written text, writing in a structured format, or employing executive functioning skills (What is a learning disability, n.d.). One to one technology can now be customized to meet the individual needs of particular students (Lei & Zhao, 2008).

Second, assistive technology that is provided on an individual basis is sometimes seen as providing an unfair advantage on assessments for students with SLD (Edyburn, 2006). This attitude reflects a preference for “naked independence” or performance without external supports or resources (Edyburn, 2005). In classrooms, this bias is at times reflected in teacher resistance to the use of such technology, even for the purpose of skill development because it disadvantages other students, creates conditions that are not always replicable, and relies on tools that will not be allowed on standardized tests (Edyburn, 2006).

Third, nearly 1/3 of assistive technology devices are abandoned by students with disabilities (Todis, 1996). Reasons for AT abandonment include difficulty of use, perceived value in learning, and challenges faced in repairing damaged equipment (Mull & Stillington, 2003). In addition, students with disabilities often abandon assistive technology that illustrates an obvious difference with their peers, making one to one a better option than individual technology in terms of social anxiety (Riemer-Reiss & Wacker, 1999; Hargreaves & Braun, 2012).

Most importantly, one to one technology has the potential to increase the self-efficacy of students with SLD. One to one access gives an opportunity for students to master the tools associated with their device (Penuel, 2006), which may alleviate the academic frustration
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common among students with SLD (Sawyer, Graham, & Harris, 1992). This is particularly important given that self-efficacy is so closely associated with students’ attitudes toward learning and achievement (Zimmermann, 2000).

However, although uniform student access to technology is important, the real digital divide may lie in the nature of teachers’ and students’ use of technology, not just in its mere presence (Warschauer et al., 2014). This applies to students with low socio-economic status, and also to students with special educational needs including those with specific learning disabilities. Assistive technology abandonment is a significant challenge for individuals with disabilities and this is often the result of poor training or follow up equipment (Mull & Stiltington, 2003). While there is broad research on the use of assistive technology, including one to one laptops, to support the needs of students with specific learning disabilities, no attempt has been made to analyze how one to one programs impact these students’ self-efficacy. This is the expressed intent of the present research.

**Potential significance of the study**

Technology offers the potential to increase student achievement by providing more engagement, relevance, and authenticity. However, this technology also presents the danger of leaving behind broad subsets of students with disabilities including those with SLD. The one to one program is emerging as a popular platform of technology integration in schools, but there is little research to date on the value of these programs and none specifically directed at middle school students with LD. This study will aim to bridge the gap between this model of classroom technology and the fundamental needs of students by exploring the impact of this program at one
Guiding Questions

The primary purpose of this one-year longitudinal multiple case study was to examine the impact of a one to one laptop program on the self-efficacy of nine middle school students with learning disabilities and to identify potential factors that supported or hindered their self-efficacy. There is evidence that technology, in general, can support the learning of students with specific learning disabilities (Hargreaves & Braun, 2012; MacArthur, 1996; Forgrave, 2002; Raskind & Higgins, 1998; Adam & Tatnall, 2008). There is also evidence that one to one technology can support student engagement and learning in general (Silvernail & Lane, 2004; Penuel, 2006: Bebell & Kay, 2010) and specifically for students with disabilities including those with SLD (Harris & Smith, 2004; Eden, Shamir, & Fershtman, 2011). However, no research to date has examined how one to one laptop technology, specifically, supports or hinders the self-efficacy of students with learning disabilities.

In order to uncover the relationship between this one to one laptop program and student self-efficacy, the study was guided by the following questions:

- How do middle school students with specific learning disabilities feel that 1:1 technology influences their academic experience?
- What characteristics of 1:1 programs present particular challenges or opportunities for students with learning disabilities?
How do middle school students with specific learning disabilities manage digital schoolwork?

Do middle school students with learning disabilities find that a 1:1 program can help to create a more equitable learning environment?

Theoretical Framework

This study is an examination of individual students’ experience in a one to one laptop environment at a particular middle school. It is also a description of the multifaceted context behind this experience. The story of these students begins with their current academic strengths and challenges, their experience to date at this middle school, and the introduction of the school’s one to one laptop program within a broader school culture. To address the complex experiences of the students and the multifaceted context of these experiences, a multiple case study approach was employed to examine the experiences of these students with specific learning disabilities. Certainly, the case study approach is well suited to describing the complex interactions of the many factors at play in this study (Yin, 2003). Narrative analysis was utilized to examine the students’ descriptions of their experiences and feelings throughout the one to one program (Merriam, 1998).

Activity Theory

Activity theory is a most appropriate theoretical framework when considering the classroom experience of students in a one to one laptop environment because of its emphasis on the learning process as one that is heavily dependent on context (Anthony, 2012). Three key principles of activity theory guide the observation of behavior among students in a classroom.
First, the primary unit of analysis is an activity system, which consists of interactions between individuals. Second, history and background are essential considerations when examining an activity system. Third, tensions within the activity system have the potential to be sources of disruption and innovation (Engestrom, 1993). In the case of the one to one laptop program, the activity system is the classroom, moderated by a broader context of classroom culture and mores, and with the laptop introduced as a source of possible disruption and innovation.

In addition, activity theory calls for an examination of the learning process in the spaces that exist between individuals in the classroom, in the interactions between teacher and student and student and student (Engestrom, Miettinen, & Punamäki, 1999). Given the way that a laptop serves as both a platform for classroom learning and also as a means of communication and collaboration, activity theory is, again, the most appropriate framework for examining a one to one laptop program.

Activity theory has developed through three generations that define the impact of mediating artifacts on the relationship between a subject and object. It is helpful to review the evolution of activity theory to situate the most recent model within its broader context. Vygotsky (1978, 1997) first defined learning as an activity consisting of an individual (the subject) who uses tools to mediate actions toward some specific goal (object), which can be tangible or a skill or concept (see figure 1). In addition, the learning activity not only can achieve the original object, but also can help the user to develop learning strategies. So, this meta-cognition allows an individual to learn thoughtfully and to guide future learning (Roth & Lee, 2007; Thorne, 2005).
The second generation of activity theory placed a greater emphasis on interaction between individuals as part of a community (Engestrom, 2001). In other words, the primary unit of analysis is an activity in the context of a community. In this conception, the smaller triangle in the upper half of the larger one represents Vygotsky’s original model (Yamagata-Lynch, 2010). Additional elements describing the effects of group activity make up the bottom points of the larger triangle (see figure 2).

Each point is a locus of action in an environment. The subject is the individual or group who is participating in the activity being studied. The object is the immediate result of the activity and the outcome is the longer-term goal of the activity. Tools and signs are the physical and non-physical devices that the individual uses to achieve the object. The three points on the
bottom of the triangle make up the social context of the activity system. First, community is the group involved in the activity and guides the individual’s actions. Second, rules are the norms and standards that guide participation in the action. Third, division of labor defines how tasks are divided between people in the activity system (Engestrom, 2001).

The third generation of activity theory emphasizes multiple activities and the negotiation between them. This design is meant to account for interactions between activity systems, which might include dialogue between the systems, varying perspectives, and overlap between systems (Engestrom, 2011). It also could be used to describe patterns of interaction in inclusive classrooms with a mix of students with and without special education status, in specialized classroom with a group of students with similar special educational needs, and in online environments used to supplement classroom instruction. Further, the interaction of multiple activity systems in the current model produces a “potentially shared or jointly constructed object,” which in this study would include the potential impact on student self-efficacy.

Though the common unit of analysis in activity theory is the individual, there must always be an accounting of context and its relation to interactions of individuals with one
another. Further, even with a primary focus on the experience of individual students, the “object of our research is always essentially collective” (Kuutti, 1995, p. 23). In the case of this study, the context of the students’ classroom experience is a kaleidoscope of statutory language concerning students with specific learning disabilities as well as school policies regarding special education and the one to one laptop program.
The Context

This examination of the one to one experience aims to describe the experience of individual students with SLD within a context of their middle school classrooms, one school’s special education program, and the approach toward SLD under United States and Massachusetts law. By looking at the impact of this one to one program on the self-efficacy of these students it will be possible to identify important considerations when introducing one to one programs in general.

Prior to beginning this examination of the program, it was important to identify and organize the goals and objectives of the program, resources that will support it, and other elements that will affect the success of the plan (Trochim, 1989). The experience of the students is partially guided by an individual education plan (IEP), a personalized blueprint for student learning. In some cases, the student’s IEP specifically addresses both organizational challenges and the use of technology. In the past, the school has met these challenges with tools and resources for that individual student. However, the one to one laptop program will, in some cases, allow the school to support individual student needs with a common device, a device and a technology accessed by all students in the school.

The one to one laptop program at this particular school is the culmination of sequenced preparation undertaken by school administrators, teachers, and students. Four years ago, the Google Apps platform was introduced as a means for faculty to e-mail and to share documents. The following year, Google Apps was opened up to students at the middle school. Subsequent hardware purchases have focused on expanding access to the Google Chromebook, a laptop computer that uses the school’s wireless connection to access a variety of cloud-based apps. Two
years ago, one cart of Chromebooks was offered to teachers as a pilot program for the one to one. Finally, last year, ten Chromebook carts were offered at the beginning of the school year and by the Spring students in grades 6 and 7 were using a Chromebook throughout the day and then returning it to their home room class prior to dismissal.

In addition to understanding the goals of the one to one program, a program logic model is utilized to illustrate and guide the conceptual framework by describing the relationship between the context, the program, and its impact on student self-efficacy. Program logic models are an illustration of program theory, which helps to guide a program study by identifying components of the program and the relationship between these components (Cooksy, Gill, & Kelly, 2000). In the case of this one to one program, such a model will be helpful.

Program theory was described by Stake (1967) as manner of describing programs with context in the form of antecedents, a series of activities and outputs, and outcomes. Later formulations account for four major program areas: resources, activities, outcomes and outputs, which can be used as a platform for a critical analysis of the program (McLaughlin & Jordan, 1999).

The logic model for this study is below:
Inputs incorporate the contextual layers of this study as both defined by national/state and school policies. In addition, a technology strand of the inputs columns accounts for national technology standards, individual student and teacher professional learning networks (PLN), and general information about the capability of Chromebooks. Further, at the school level, there is the school’s mission statement, professional development, and planning for the one to one laptop program and its relevance for student use of technology and the experience of special education students.

Outputs in this model described the experiences of students in the classroom and in online activities supported by the one to one program. One part of this body of experience consists of learning activities that rely on use of the one to one laptop. These activities are divided between use of the technology as a supporting or assistive technology (AT) and its use as
a generic classroom resource. A second element of the experience is defined by actual student participation in these learning activities.

Potential outcomes of the one to one program included short-term goals related to more successful completion of classwork including online discussions and a primary long-term goal of increased self-efficacy. The two may also work symbiotically; a student’s participation in class activities improves, self-efficacy follows, which promotes better participation. A self-confident use of technology has the potential to become a key asset as the students continue their academic career.

Overall, this study examined elements of the one to one laptop program at Johnson Middle School in order to describe aspects of the program consistent with higher levels of self-efficacy among nine middle school students. Activity theory was employed in order to account for the multi-faceted context of students’ with SLD experience at the school. The next chapter provides a foundation of information on the wide range of research studies that have individually addresses topics related to self-efficacy, students with SLD, and one to one laptop technology.
CHAPTER 2: Literature Review

This literature review provides the research context for this study. It begins at the student level with a description of the history of identifying individuals with learning disabilities (LD). Assistive technology is presented as a helpful supplement to broader learning strategies for students with LD. Then, one to one laptop programs are described as both an alternative to and a platform for specialized technology that is provided to individual students. Finally, I summarize research on the nature of self-efficacy and describe how it has become a key factor in explaining student academic achievement.

Learning Disabilities
The term “learning disabilities” emerged in the early 1960’s from the research of Dr. Samuel Kirk in order to categorize students with low academic achievement, but who did not fall into existing categories of disability. Kirk (1962, p. 263) defined LD as “a retardation, disorder, or delayed development in one or more of the processes of speech, language, reading, spelling, writing, or arithmetic resulting from a possible cerebral dysfunction and/or emotional or behavioral disturbance and not from mental retardation, sensory deprivation, or cultural or instructional factors.” This definition attempted to address the many academic and language challenges faced by students with cerebral or emotional dysfunction not specifically defined (Hammill, 2001).

Only three years later Bateman (1965) offered a revised definition that more strongly emphasized the gulf between the academic potential and actual performance of students with LD. Soon after, the National Advisory Committee on Handicapped Children (NACHC), initially headed by Dr. Kirk, produced a definition that modified the original definition by excluding
emotional disturbance as an explicit cause of LD, only recognizing LD in children, and by adding thinking disorders as a category of LD (Hammill, 2001).

Over time, variations on these definitions have been driven by several motivating factors. In some cases, LD is defined pragmatically, in order to differentiate it from other diagnoses and therefore to control the provision of services. Other definitions are driven by a desire to contain knowledge about LD, to provide a starting place in terms of research. A final subset of definitions is aimed at categorizing students in order to establish best practices for teachers (Vellutino, Scanlon, & Lyon, 2000).

By the mid 1970’s, researchers identified a subset of students struggling with reading who otherwise had good academic performance and average or above average intelligence (Rutter & Yule, 1975). This conclusion, which defined LD as low achievement in otherwise normal students with at least average intelligence was codified with US law PL 94-142 and became the de facto standard for defining LD for nearly three decades (Vellutino, Scanlon, & Lyon, 2000).

The 2004 Individuals with Disabilities Education Improvement Act (IDEA) aimed to stem the rising tide of students diagnosed with LD with a significant philosophical shift (Fuchs & Fuchs, 2006). IDEA moved away from this emphasis on the aptitude/achievement discrepancy and instead encouraged the use of a Response to Intervention (RTI) model, which calls for the identification of students with SLD as those who fail to respond to standard evidence-based instructional practices (Jackson & Karger, 2015).

Because RtI requires the sustained delivery of evidence based instructional practices along with targeted interventions for poor responders, RTI is both a tool for prevention and for
identification of LD (Jackson & Karger, 2015). Through rigorous progress monitoring, at-risk students are given a series of academic interventions in a series of tiers with each tier increasing in duration, frequency, and focus of the intervention (Fuchs & Fuchs, 2006). Students who do not respond to any of the tiers are labeled as having LD. RTI tends to follow a problem solving approach in which a set of interventions is planned by school-based teams to meet the needs of particular students (Jackson & Karger, 2015).

One emerging component of the RTI approach is the use of technology to support evidence-based practices (Smith & Okolo, 2010). This strategy builds upon evidence that technology-enriched instruction with effective professional development produces the largest gains in reading achievement (Cheung, Slavin, Groff & Lake, 2008). In some cases, technology supplements traditional classroom instruction with a variety of applications that can be useful for all students (Basham et. al, 2010). For example, the Google Apps suite of applications allows students to work collaboratively in real-time and to save work in progress in the cloud so that it is accessible from any location (Herrick, 2009). In other cases, assistive technology (AT), which is specialized for students with particular needs, is used to improve student learning. This includes a variety of text to speech options including Read & Write for Google, which reads written text to struggling readers at a pace most appropriate to that student (Read&Write Literacy Software, n.d.).

Assistive Technology

The term “assistive technology” was coined in 1982 by John M. Williams, a New York Times writer, to refer to any specialized technology that supports people with disabilities. Mr.
Williams was a lifelong stutterer helped by computer-based speech therapy. In the process of writing about his experience, he arrived at the term “assistive technology” and it passed muster with his editor. Before long, the term had entered the modern parlance for any modern technology that supports those with disabilities (Family Center on Technology and Disability, 2008).

More recent definitions have emphasized differences between digital AT and older traditional supportive technologies. Given changing technology, AT has come to represent a particular type or use of digital technologies that “allows one to increase, maintain, or improve the functional capabilities of an individual with special learning needs” (Edyburn, 2000, p. 127). This definition thus distinguishes the digital technologies that comprise assistive technologies from more traditional forms of technological assistance for people with disabilities such as wheelchairs, hearing aids, or eyeglasses.

In response to IDEA and its discussion of assistive technology, Edyburn (2006) examined AT uses for students with mild disabilities including students with learning disabilities. AT for students with learning disabilities comes in many forms depending on the need of the student. Generally, where issues reside in areas of reading and writing, these resources fall into three major categories: speech synthesis (text to speech), organizational software, and voice recognition (speech to text), all of which can have a powerful impact on student self-esteem and motivation (Forgaves, 2009). For example, text to speech applications provide powerful benefits for students with learning disabilities and in many cases, can make reading a positive experience whereas in the past it has been a major source of frustration. Students with dyscalculia can also
benefit from AT in the form of drill and practice apps, interactive video lessons, and calculators (Shalev, 2004)

**Assistive Technology and Universal Design for Learning**

One powerful bridge from assistive technology to teaching and learning is Universal Design for Learning (UDL), a curriculum design model that emphasizes flexibility in order to meet the needs of students with a variety of learning preferences (Rose and Meyer, 2002). UDL looks at curriculum in the ways we engage students’ attention, how we represent information to students, and how students demonstrate what they know or can do. All of these areas can be enhanced with technology. For example, engagement can be enhanced with interactive lecture slides that allow the audience of students to interact directly with the presenter’s visual content. Information that was previously only presented to students in written form can be read aloud, supplemented with video, or customized based on the reading level of the student. Students that may have demonstrated learning via a classroom presentation might instead create a podcast, design a website, or craft a series of social media posts.

For some, assistive technology and UDL are complementary or even “two sides of the same coin” (Rose, 2005, p. 507). Others even question whether UDL is possible without technology (Edyburn, 2010). However, there is no doubt that digital technology can support UDL in ways that were previously impossible (King-Sears, 2009).

A technology-infused UDL school environment will not succeed without broad backing for the use of technology to support learning (Morrison, 2007). However, such broad usage often bumps up against the challenge of integrating technology in classrooms that are already faced with myriad demands on teacher time. One potential platform for the broad use of technology to
support the learning of all is to identify common technologies that can be customized for individual students. Perhaps the most powerful example of this concept is the one to one laptop program, which calls for every student to be provided with a common device that has a variety of avenues for customization.

The Google Chromebook, the one to one device that is the focus of this research, is a unique device in that it blurs the line between software and hardware. Most Chromebook customizations and applications are cloud-based and therefore travel seamlessly from device to device and do not require installation or configuration files. Many Chromebook customizations focus on the way that the user interfaces with the device. Audio augmentation can be enabled so that one can navigate the screen without the use of visual cues. In addition, an external mouse or scroll wheel can supplement the track pad built into the device, and the screen can be enlarged or adjusted to provide additional contrast (Turn on Chromebook accessibility features, n.d.). Other Chromebook features personalize the way that online content is consumed including enlarging and enhancing text, promoting concentration by removing distractions and restricting access to certain websites, and converting text into speech.

One to One Technology

One to one programs are emerging as one of the most popular models of technology integration in schools (Abell Foundation, 2008; Hayes & Greaves, 2008). Elements of these programs vary, but commonly provide an Internet-connected computer to every student in order to support the completion of a variety of academic tasks (Penuel, 2006). The growth of one to one is being driven by a number of factors including the availability of wireless network access and increases in the power of smaller low-cost mobile devices (Penuel, 2006). In addition,
several broader goals drive schools’ enchantment with expanded technology use including improvements in student learning, a narrowing of existing digital divides between students, a need for better preparedness for the global economy, and a desire for a real transformation of teaching enabled by technology (Penuel, 2006). However, there is mixed evidence for the effectiveness of technology to help meet any of these goals.

There are several reviews of the research on one to one programs, which identify a number of variations in the nature and implementation of one to one programs including the type of device used, plans for device storage and charging, and correlations with broader efforts at improving teaching and learning (Zucker, 2004; Penuel, 2006; New South Wales, 2009; Fleischer, 2012). Among the categories of one to one devices are mobile tablets such as iPads and the Nexus 7, laptop computers including Macbooks and Windows laptops, and hybrid devices such as the Chromebook that replicate the portability and ease of use of a tablet while also including a keyboard and a trackpad like a laptop. In addition, some schools choose to allow students to bring their one to one device home while others store and charge the devices over night in the school building. Finally, one to one programs are often introduced in partnership with broader effort at improving teaching and learning with an emphasis on 21st century skills (Lowther, Inan, and Strahl, 2012).

Impact of 1:1 on Student Learning

One to one programs can offer benefits for student learning in terms of engagement (Cromwell, 1999), motivation and self-regulation (Fairman, 2004), and behavior (Maine Education Policy Research Institute, 2003). These benefits are partially driven by in increase in individual student/teacher interactions in one to one environments (Rosen & Beck-Hill, 2012).
On the other hand, one to one devices do present a danger for student distraction and can limit face to face interactions, which have the potential to be more meaningful (Hatakka, Andersson, & Grönlund, 2012).

Much one to one research attempts to measure any effect of the device on student achievement in particular subject areas. Several studies suggest a positive impact on student ELA achievement in general (Gulek and Demirtas, 2005; Bebell and Kay, 2010; Zheng et al., 2013). One, in particular, found a greater impact of one to one on ELA achievement compared to portable laptop carts (Russell, Bebell, & Higgins, 2004). Other studies point to improved student writing with the use of laptops (Gulek & Demirtas, 2005; Lowther, Inan, & Strahl, 2012; Rosen & Manny-Ikan, 2011) and in particular for at-risk students (Zheng et. al., 2013).

Other studies have found a positive correlation between one to one laptop programs and learning in math (Grimes & Warschauer, 2008; Gulek & Demirtas, 2005; Rosen & Manny-Ikan, 2011), science (Dunleavy and Heinecke, 2008; Crook, Sharma, and Wilson, 2015), and social studies (Diem, 2000). However, there is evidence that any effect on achievement does not occur consistently in all academic subjects (Bebell & O’Dwyer, 2010). For example, several studies suggest little value of laptop programs for math (Bernard et al., 2007; Dunleavy & Heinecke, 2008; Shapley et al., 2011) or reading (Bernard, Bethel, Abrami, & Wade, 2007; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011). In addition, any correlation between one to one programs and improved performance on large-scale standardized tests is tenuous (Rockman, 2003)
Student use of computers at home appears to be helpful in maximizing the impact of one to one on student learning (Shapley, Sheehan, Maloney, and Caranikas-Walker, 2010; Kay, 2010). This suggests that one to one program in which students are able to bring devices may have more potential to improve student learning. Certainly, it is clear that access to technology alone will not guarantee an increase in student learning (Warschauer et al, 2014).

1:1 and Instructional Practice

Acceptance of one to one as a transformative platform is running headlong into skepticism that technology can or will have any impact on classroom instruction (Cuban, 1999). In many cases, one to one is replacing the model of school technology use that emerged in the late 1980s and early 1990s, which called for computers to be centrally located in a dedicated computer lab (Means & Olson, 1995). Student access to dedicated computers labs was limited because of limited availability, which restricted any transformative power of the technology (Kozma, 1991). One to one technology has the potential to overcome this limitation, but only when it is paired with adequate support, professional development, and curricular integration (Warschauer et. al., 2014). Without this foundation of support and integration, the introduction of laptops can produce more anxiety about technology among teachers and in fact, be counterproductive (Donovan, Hartley, & Strudler, 2007). In extreme cases, fears about technology misuse and expense have resulted in one to one programs being scrapped (Hu, 2007).

In addition, when one to one technology is introduced without support for changes in teaching, it often tends to supplement existing practices by replacing traditional tools used for things like note-taking and Internet research (Bebell & Kay, 2010; Dunleavy, Dexter, & Heinecke, 2007; Lei, 2010). The replacement-only used of technology tends to be the result of
teachers only adapting existing practices to include technology rather than developing from scratch (Penuel, 2006).

On the other hand, computer use that is integrated in classroom practice is more likely to produce a meaningful change in instruction (Dawson, Cavanaugh, & Ritzhaupt, 2008; Inan & Lowther, 2010b; Zucker, 2004). Further, the expanded access that comes with one to one laptop programs is more likely to produce this integration (Roschelle & Pea, 2002; Roschelle, Penuel, & Abrahamson, 2004). One to one programs can inspire teachers to have greater confidence in their ability to integrate technology (Lowther, Inan, Ross, & Strahl, 2012) and multiple studies suggest that one to one laptops support the incorporation of research-based practices that emphasize student-centered learning (Cavanaugh, Dawson, & Ritzhaupt, 2011; Danielsen, 2009; Dawson, Cavanaugh, & Ritzhaupt, 2006; Donovan, Hartley, & Strudler, 2007).

One to one access does tend to promote independent learning where students have more responsibility for their own learning progress (Rosen & Beck-Hill, 2012). For example, the implementation of a one to one laptop program in Irving Independent School District (IISD) resulted in a shift from predominantly whole class instruction to independent learning guided by the teacher (Owen et. al., 2006). One potential negative side effect of this independent access is a reduction in student to student collaboration as less teamwork is needed as with shared devices (Russell, Bebell, & Higgins, 2004).

Successful integration is also dependent on the beliefs and attitudes of teachers (Becker & Anderson, 2000; Becker, Ravitz, & Wong, 1999; Ertmer, 1999). Plainly, teachers who do not believe that technology supports the general curriculum will not use it (Sarama, Clements, &
Henry, 1998). Other teachers may appreciate technology as a supplement to existing teaching strategies, but not as a central element of learning (Garthwait & Weller, 2005).

Professional development can play a key role in promoting these beliefs (Kanaya, Light, and Culp, 2005). For example, an emphasis on technology that complements pedagogical skill and content expertise is more likely to support effective teaching (Koehler & Mishra, 2008). Further, professional development should address teachers’ skepticism about the value of technology (Dunleavy, Dextert, & Heinecke, 2007).

School leadership is also central to the success of a one to one laptop program. Maine’s statewide one to one laptop program, which began in 2002, illustrated that one technology leader can make all the difference in the success of such programs (Silvernail & Lane, 2004).

Impact on the Digital Divide

A combination of flexibility and affordability may particularly support students with low socio-economic status and other groups at risk (Shuler, 2009). For example, there is evidence that these programs have the potential to increase motivation among students who historically underachieve (Fairman, 2004; Harris & Smith, 2004; Silvernail, 2007). In addition, one to one programs may have value for the English language skills of dual language learners (Turgut, 2012). In general, technology may pay off in different ways depending on who is using it. Technology use does not occur in an independent vacuum, it is "socially shaped or socially constructed: its properties are largely if not exclusively determined by the interpretive frameworks and negotiations of relevant social groups" (Boudourides, 2003, p.67).
Self-efficacy

Self-efficacy is defined as a person’s belief that he or she can act in such a way as to produce a desired outcome. This lies in contrast to an outcome mentality, which focuses on the likelihood that an action will produce a particular outcome (Bandura, 1977). The concept of self-efficacy emerged from broader conversations about social learning theory, which “approaches the explanation of human behavior in terms of a continuous reciprocal interaction between cognitive, behavioral, and environmental determinants” (Bandura, 1977b, p.vii). Specifically, there are four key factors that influence self-efficacy: (1) performance of a task (2) an estimation of the effects of performing a task (3) social response from others; and (4) physiological responses from the task. Among these, performance or mastery of a task is the most influential factor (Bandura 1997). It is no surprise then that self-efficacy supports academic achievement directly and shapes student goal setting, which also supports achievement (Zimmerman, Bandura, & Martinez-Pons, 1992).

Measures of self-efficacy are frequently employed to gauge student perception of their abilities. There is no universal measure of self-efficacy, but student self-efficacy is generally assessed with surveys of perceived ability to complete problems, answer questions, and perform well on certain tasks or in specific subject areas (Bandura, 2006). In some cases such Barry Zimmerman and Manuel Martinez-Pons’ (1988) study of high school students, students examines a mix of actual math and literacy problems, but didn’t attempt to solve them, just self-assessed their capability to answer the questions. Studies frequently utilize self-efficacy surveys in cooperation with other measures including interviews of students and classroom observations (Zimmermann & Pons, 1986).
Zimmermann (2000) described the importance of student self-efficacy for motivation and learning including choice of learning activities, degree and maintenance of effort, and emotional response to work. Students with high self-efficacy are more likely to select challenging tasks in mathematics (Bandura & Schunk, 1981) and writing (Zimmermann & Kitsantas, 1997) and also to set more challenging goals for themselves, in general (Zimmerman, Bandura, & Martinez-Pons, 1992). Student effort is also closely correlated with self-efficacy (Zimmermann, 2000). Students that have no self-efficacy tend to exert a lower degree of effort on learning tasks (Bandura, 1993). In addition, students’ perception of their ability to do work plays a significant role in defining student emotional response to this work (Bandura, 1997). The end result is that students with higher self-efficacy are more skilled at self-regulating learning, which tends to produce higher overall academic achievement (Multon, Brown, & Lent, 1991).

Students with learning disabilities face particular challenges in developing strong self-efficacy, as well as positive academic attitudes (Tabassam & Grainger, 2002). However, a self-directed instructional strategy did produce an improvement in the self-efficacy of students with LD suggesting that intentional programs to improve self-efficacy may pay off (Graham & Harris, 1989). Specifically, learner control can have a positive impact on student achievement for students with strong self-regulatory skills suggesting that an intentional program aimed at self-regulation may pay off for students with LD (Winters, Greene, & Costich, 2008). One example of this strategy is a program of self-regulated strategy development (SRSD) including goal setting, self-recording, and self-assessment that resulted in improved writing skills (Sawyer, Graham, & Harris, 1992). Butler, 1998; Zimmerman, 1996 found academic interventions may
be more effective when they incorporate counseling and social behavioral intervention. Self-determination (Wehmeyer, Agran, & Hughes, 1998).

Bandura (1997) and Goddard, Hoy, & Hoy (2000) have described the concept of collective teacher efficacy, an amalgam of individual teacher efficacy that has a significant impact on overall student achievement. Though this study focused on student self-efficacy, the notion of a collective student self-efficacy may be a valuable construct in considering the importance of a whole-school initiative such as a one to one laptop program.

One to One Technology and Self-efficacy

Self-efficacy is particularly important in relation to technology use because it often requires the user to feel comfortable with a process of trial and error. The alternative is that technology can promote a “philosophy of fear,” a broad feeling of unease that comes from a lack of experience (Ribeiro, 2014). Studies of undergraduate students (Wang, Shannon, and Ross, 2013) and teachers (Albion, 1999) have shown that technology confidence supports overall self-efficacy.

One to one laptop programs would appear to have the potential to support students’ self-efficacy based on prior research on the impact of technology use on self-efficacy. For example, use of geographical information system (GIS) software in a project-based learning environment increased middle school students’ science self-efficacy (Baker & White, 2003). Also, student self-efficacy was positively impacted by teacher use of PowerPoint to supplement traditional lecture-style teaching (Susskind, 2004). Finally, teacher education students’ computer self-
efficacy was positively impacted by the amount of use and personal ownership of the device (Albion, 2001).

However, none of these programs focused on the use of technology by students with SLD and there is the potential that technology may be particularly effective in supporting the self-efficacy of students with LD. In general, students in need of additional learning support benefit most from technology “that is designed to promote high levels of interactivity and engagement with data and information in multiple forms” (Darling-Hammond, Zielezinski, & Goldman, 2014, p. 15). Interactivity provides an immediate and tangible interaction with the technology, which is particularly important for students who are struggling with certain elements of learning. In addition, providing multiple modes of interaction increases the likelihood that students will identify with one or more platforms for learning well-suited to their learning style. In particular, one to one programs allow students to customize how information is perceived and promote a higher comfort level with technology, which has the potential to boost self-efficacy, but no research to date documents the effects of digital tools on self-efficacy outcomes.

There is significant research described above that illustrate the classroom experiences of students with SLD, the significance of one to one technology, and the role of self-efficacy in defining student learning. However, no research to date has described the impact of one to one technology on the self-efficacy of students with SLD, which was the goal of this study. The following chapter describes the methodology employed for this study.
CHAPTER 3: Methodology

Study Design and Rationale

This study employed a longitudinal multiple case study narrative approach to examining the experience of students with specific learning disabilities in a one to one laptop program (Eisenhardt, 1981; Sandelowski, 1991). The data collection component of the study consisted of student surveys at the beginning and end of the school year, interviews with students, parents, and teachers, and analysis of online interactions over a period of one school year for a group of nine students with specific learning disabilities.

The case study method is designed to overcome the inability to create an experimental environment by strategically constructing all aspects of the research process from design, data collection, and data analysis (Yin, 2003), a strategy I also utilized in developing a broad source of data concerning the experience of these nine students. In all, I examined the experiences of these nine middle school students with learning disabilities using a variety of vantage points including surveys, interviews with the students and their parents and teachers and a review of online activities.

A longitudinal model was most appropriate for this study because of the nature of technology use and the tendency for technology comfort and self-efficacy to develop over time. Though this study occurred over one year, it did collect data at multiple intervals in order to gauge any change over the school year, which is consistent with the model. Longitudinal research is aimed at identifying patterns of change and the direction and magnitude of change by
collecting data over time (Menard, 2002). The opportunity to collect data over time was especially helpful with this study of the one to one program because the program was introduced at the beginning of the school year. The students who participated in the study may show an initial anxiety or excitement with one to one technology that fades throughout the school year. On the other hand, students may gain a level of comfort with the one to one device throughout the school year. By tracking the students’ experiences throughout the year, it is possible to identify these trends.

In addition, a narrative approach allowed me as researcher to coalesce the variety of data sources and experiences of the participants into a set of life stories that capture their experience with technology and learning and subsequent impact on self-efficacy during that school year (Sandelowski, 1991). This required a deep understanding of the experience of a student beginning a one to one laptop program while navigating the tumult of the middle school years. It also allowed me to explore causality with the students in the study, to address events related to technology use specifically and to explore their self-efficacy in general.

Research Setting

The study was conducted at a medium-sized middle school in eastern Massachusetts where I currently work as a technology integration specialist. Certainly, there were positives and negatives to conducting research in my own school system. Benefits of this plan included convenience of data collection and my familiarity with the school’s plans for its one to one laptop program as well as the broader school culture around technology and special education. In addition, my ready access to students, teachers, administrators, and information technology staff allowed for spontaneity and regularity in data collection that would otherwise be impossible. On
the other hand, I am opening myself up to questions as both an employee and a researcher. To counteract questions about my work for the school system, I emphasized confidentiality of student participants and the value of the study for the district. My research overview clearly described my role and how I have counteracted any conflict of interest as an employee and researcher.

Participants

Students in grades 6-8 were selected for potential participation based on district identification as having specific learning disabilities. This purposeful sampling allowed me to identify students who have the most potential to benefit from the use of one to one technology in comparison to other disability categories (Patton, 2005). District special education staff conducted a search of the district’s special education database for students with a SLD diagnosis to produce a list of all matching students. SLD as defined in the district’s special education software is an umbrella term that encompasses many variations on LD including dyslexia, dysgraphia, and dyscalculia and this research looked at differences in the experiences of students with these variations of SLD. A recruitment letter was sent to the parents of these students along with detailed study information. Sample selection of parents who expressed interest was stratified by student race, gender, and type of learning disability to produce variability in these three group variables.

Data Sources

The multiple case study approach calls for theory to be developed as an element of data analysis and therefore is strengthened by triangulating a variety of data sources (Eisenhardt, 1989). With this in mind, I used surveys at the beginning and end of the school year, as well as a
series of interviews with students, parents, and teachers, and examination of online interactions to provide a full picture of the students:

**Survey**

Students were surveyed at the beginning and at the end of the study in order to add additional detail to the analysis of impact on self-efficacy. The survey (see Appendix I) is a modification of Pastorelli et. al.’s (2001) Bandura-inspired survey of student self-efficacy (Bandura, 1989). Bandura’s Children Perceived Self-Efficacy (CPSE) scales consisted of 37 questions within seven aspects of self-efficacy: academic achievement, self-regulated learning, leisure activities, self-regulation, social self-efficacy, self-assertive efficacy, and meeting others’ expectations (Pastorelli et. al., 2001).

The current study modified the Bandura scale to make it more appropriate for the current school context and emphasis of the study while still maintaining six of the seven categories of self-efficacy. This approach is appropriate given that “an all-purpose test may have little or no relevance to the domain of functioning” (Bandura, 2006, p. 307). The survey was reduced from 37 to 25 questions in order to avoid potential survey fatigue (Porter, Whitcomb, & Seitzer, 2004). Items omitted included questions in the original formulation related to subject areas not offered in the school environment such as Italian literature and geography, questions about team sports, and a series of questions concerned smoking cigarettes and drinking alcohol. In addition, questions were added that address technology-self-efficacy specifically.
Interviews

Interviews were designed to elaborate on ideas generated from the student surveys as well as identify themes not addressed in the surveys. Each student was interviewed at the beginning of the school year and again toward the end of the school year. Interviews were conducted in a school office at a time most convenient for students and in a manner that insured confidentiality. The interview protocol was designed to address factors that support self-efficacy (see appendix II – initial student interview protocol and appendix III – follow-up protocol). Semi-structured interview protocols were designed to address broad themes related to student-self efficacy and learning. This included discussion of student uses of the Chromebook, student perception of the impact of the technology on their learning and their attitudes toward school and learning in general, and student confidence.

In addition, the primary academic teachers of the students (English Language Arts, Mathematics, Science, and Social Studies) were interviewed during the year as well. Some of the teachers had more than one student participant, but each teacher was only interviewed once. Teacher interviews were conducted in each teacher’s classroom in order to maintain confidentiality and also to allow teachers to refer to examples of student work. These interviews investigated the teachers’ perspective on the use of technology in the classroom and the students’ success in managing one to one technology. Particular attention was placed on students’ technology-supported interactions with one another in comparison to traditional forms of communication.

Finally, the parents of the students were interviewed during the school year. Parent interviews gleaned evidence related to student self-efficacy that may be more evident at home.
than in the school environment. Parent interviews were conducted at a time and place most convenient to the parents: some were completed in the school, others were conducted at home, and some were done over the phone. The parent interview protocol also followed a semi-structured protocol that followed up on themes generated in student interviews with particular attention paid to impact on homework, student attitudes toward school, and any impact on learning.

Review of online artifacts

The host middle school is in the midst of a conversion to a largely digital environment. This includes extensive use of shared digital resources and online learning management systems including Google Classroom. These online environments allow for student interaction on projects and documents, in online bulletin boards, and in virtual chat rooms. Teachers of subject students were asked to provide examples of student online interactions that either occurred in a real-time discussion format or an asynchronous discussion board. These digital social interactions were observed with particular attention to potential evidence of student self-efficacy especially in comparison to descriptions of face to face classroom interactions.

Data Collection and Analysis

The variety of sources of data and the longitudinal nature of this project make continual examination essential. Otherwise, there is a danger of reaching premature conclusions based on partially collected and analyzed data (Eisenhardt, 1989). In addition, a clear “chain of evidence” was established from student survey data to student interviews to parent and teacher interviews to evidence of online classroom interactions (Yin, 2014). The variety of sources of data and
methodological approaches also allowed for effective triangulation of the qualitative data (Denzin, 1970; Guion, Diehl, & McDonald, 2011).

I used memo-writing to organize thoughts and refine the interview and observation process and Dedoose online software to code responses to interview questions, observations, and classroom transcripts. An iterative coding procedure included an initial coding based on transcripts and appropriate measures of self-efficacy. Broad categories of self-efficacy qualities included the ability to enlist social resources, self-efficacy for academic achievement, skill with self-regulation, confidence in meeting expectations and development of self-assertive learning. A secondary focused coding capitalized on themes identified within these categories.

Coding of student interviews was conducted in two stages. The first stage utilized holistic coding, in which the researcher attempts to “grasp basic themes or issues in the data by absorbing them as a whole rather than by analyzing them line by line” (Dey, 1993). Each student interview transcript was analyzed using this strategy. Following the holistic coding, a second “structural” coding applied themes identified in the first coding as well as concepts related to self-efficacy as described by Bandura (Saldana, 2012). Parent and teacher interviews were coded based on themes identified in the student data.

Ultimately, the three bodies of data were used to help tell the story of technology use, learning, and self-efficacy of the student subjects. The narrative approach rejects the idea that there is one single truth to be revealed in qualitative research, but rather presents a subjective life-story of the study participants (Lieblich, 1998). Data analysis emphasized this story-telling philosophy by building a picture of the academic life of each individual student subject and then coalesced these individual stories into a broader narrative that described the role that one to one
technology plays in defining the school experience of students with LD.
CHAPTER 4: Research Findings

Summary of Results

This study examined the impact of a one to one laptop program on the self-efficacy of nine students at “Johnson Middle School” in order to consider whether elements of this particular one to one laptop program were consistent with higher self-efficacy among these students. This chapter presents data gathered from the following sources: interviews with the students, their parents and teachers, pre and post-surveys, and observations of digital work in order to generate a full picture of student experience in this first year of the one to one program. Following this summary, the chapter provides a brief biographical sketch of each participant, a summary of survey data, and evidence gathered from interviews and observations organized into themes that emerged as the result of the coding process.

Overview of participants (*Pseudonyms are used for all participants)

In addition to completing pre and post surveys, the nine students in this study participated in two extensive interviews, one at the beginning of the school year and one at the end. These interviews focused not only on the one to one laptop program in relation to other uses of technology and also the broader educational experiences of the students including the long-term significance of their learning challenges. I also interviewed the students’ parents and teachers and was able to learn a great deal about the academic experience of each student. Here is a brief introduction to the nine students based on these interviews and observations:

“Ashley” is a 7th grade girl with SLD primarily related to reading, but she also has challenges related to attention and memory. She has been in the local school district for her
entire life and generally enjoys school, but she began 7th grade feeling a great deal of anxiety about the increased workload with the new school year.

“Noah” is in his first year of middle school and is diagnosed with dyslexia, which manifests itself in challenges with reading, writing, spelling and math. He lived out of state and was home-schooled through 4th grade so he has only been in this school district for one year. Noah is a huge fan of anime and Disney animation and is very happy when teachers allow him to connect his work with his interest.

“Olivia” is in 7th grade and has specific learning disabilities primarily related to organization and executive functioning. Olivia’s disabilities are relatively mild and she was succeeding academically with limited accommodations prior to the introduction of the Chromebook one to one program.

“Ava” is a very social 8th grade girl who struggles academically due to a SLD related to organization and executive functioning, but has been succeeding in a full-inclusion program. She is very interested in creative writing and embraces assignments where has more freedom in her writing.

“Liam” is a 6th grade boy who primarily has challenges with organization and with writing. Liam has been in the district for all of his schooling and has generally succeeded in a regular education track of courses.

“Sophia” is in 6th grade girl and enjoys school, is quite social, and is a leader among her peer group. Her SLD primarily involves attention and grasping of higher order concepts and she
was placed in a mix of inclusion and small group language-based classes for the coming school year.

“Isabella” is new to the district for 6th grade because her family moved over the summer. Her SLD impacts her reading, writing, and math skills. She is anxious about starting in a new school, but is hoping to do well in middle school.

“Mia” is an 8th grade girl who has trouble with organizing her ideas and writing and also grammar and vocabulary. She is very passionate about cheerleading and dance and is quite social with her fellow team members.

“Charlotte” is beginning the 2015-2016 school year in 6th grade. Her primary learning challenges relate to reading comprehension and vocabulary and executive functioning skills. Charlotte enjoys school and has a small group of close friends, but tends to take a passive approach to her learning. She is very interested in technology and is a committed member of her swim team.

**Survey Results**

The survey portion of this study was a modified version of a student self-efficacy survey developed by Bandura (2006). This study used the survey to gauge student confidence in the following six categories: subject area academic strength, self regulation and executive functioning, peer pressure, social self-efficacy, self-assertive self-efficacy, and meeting others’ expectations. Students completed the survey at the beginning of the school year and again toward the end of the year in order to produce a comparison of self-efficacy at the outset of the one to one program and after one school year. Each question had 5 possible choices on a 5 point Likert
scale with higher scores indicating greater self-efficacy in a given topic area and lower scores indicated lower self-efficacy.

Based on the pre and post-surveys of Johnson Middle School students with learning disabilities (N=9), there was a significant overall difference in self-efficacy from the beginning of the year (M=3.44, SD=.56) and the end of the year (M=3.61, SD=.59), t=2.8, p ≤ .05, CI.95 - .303, .0278. See the chart below summarizing the results for six sub-categories of student self-efficacy:

<table>
<thead>
<tr>
<th>Category</th>
<th>Start of year</th>
<th>End of year</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1: academic strength</td>
<td>3.16</td>
<td>3.47</td>
<td>.31</td>
</tr>
<tr>
<td>Category 2: Self-regulation and executive functioning</td>
<td>3.46</td>
<td>3.53</td>
<td>.07</td>
</tr>
<tr>
<td>Category 3: Peer pressure</td>
<td>3.69</td>
<td>3.94</td>
<td>.25</td>
</tr>
<tr>
<td>Category 4: Social self-efficacy</td>
<td>3.49</td>
<td>3.66</td>
<td>.17</td>
</tr>
<tr>
<td>Category 5: Self-assertive self-efficacy</td>
<td>3.19</td>
<td>3.19</td>
<td>0</td>
</tr>
<tr>
<td>Category 6: Meeting others’ expectations</td>
<td>3.71</td>
<td>4</td>
<td>.29</td>
</tr>
<tr>
<td>Overall</td>
<td>3.44</td>
<td>3.61</td>
<td>.17</td>
</tr>
</tbody>
</table>
With neither a control group of students without special education status for SLD nor a group of students that completed a school year at Johnson Middle School without one to one laptop access, it is not possible to conclude that this increase in self-efficacy is unique to this student group or the result of one to one laptop access. In addition, an effect size of .30 suggests a low practical significance. However, there is value in examining the six sub-categories of the overall index to look for patterns in rates of increase in self-efficacy. In addition, it is worth noting that average student self-efficacy fell between 3 and 4 in all categories in both the start of year and end of year surveys, indicating roughly moderate self-efficacy at both the beginning and end of the study.

Student self-efficacy in relation to academic subject performance showed an average increase of .31 or a 9.8% increase from the beginning of the school year on the 5 point Likert scale. There was an increase in all subject areas except for social studies confidence, which did not change from the start of year survey. The highest increase in academic subject self-efficacy occurred in science, with a .5 increase from 3.25 to 3.75. Math self-efficacy increased .25 from the beginning to the end of the year. The survey also showed that students had greater social self-efficacy (.17 increase), self-efficacy for resisting peer pressure (.25), and the ability to meet others expectations (.29 increase).

However, self-efficacy in relation to self-regulation and executive functioning had a relatively small increase. The overall change for the sub-category was .07 including an increase of .5 for student responses to the question: “How well can you organize your school work?” and a .25 increase for a question about note-taking in class. However, students had decreases in self-efficacy related to work completion, motivation, and distraction. The average score for “How
well can you study when there are other interesting things to do?” had the highest decrease from the beginning of the year to the end of the year -.5. This represents a 14% decrease in self-efficacy in this area on the 5 point Likert scale. There was also a drop in the average response to the question “How well can you motivate yourself to do school work?” Finally, there was no change in self-efficacy for the self-assertiveness category, which emphasized student ability to express opinions when others disagree.

Because the survey sample was limited to the nine students in the study of one program at a single middle school, this data is of limited value except in partnership with the other sources in this study. It would have been helpful to have had a comparison group of students without a diagnosis of specific learning disabilities as well as another made up of students at this school without the introduction of the one to one laptop program. Without control group comparisons, survey data on self-efficacy gains for students with SLD cannot be compared with non-disabled student participants in the program or students with SLD who did not participate in the program. Nonetheless, the survey data can be helpful when viewed alongside interview and observational data to help explain the themes discussed below.

Qualitative Results Overview

The primary source of data in this study consisted of conversations with students, teachers, and parents addressing a variety of topics related to student self-efficacy and the use of technology. This included student attitudes toward school and academic work. An iterative coding process applied to the interview transcripts inductively produced the following themes or areas of emphasis among the participants: the relevance of respectful relationships within the
school community, an acceptance of technology’s value in developing basic academic skills, including reading and writing, and the importance of a growth mindset in relation to technology among students and teachers. In total, these themes represented an emphasis on technology practices that were consistent with elements of an existing powerful school culture, which Deal and Peterson (2016) describe as “the glue, the hope, and the faith that holds people together.”

School culture: respectful relationships

Consistent in my interviews with students and their parents was a central theme that the one to one laptop program was most valuable for student self-efficacy in ways that it supported and was supported by an existing school culture that respected differences in learning among students and sought to employ purposeful uses of technology to address these differences. This schoolwide culture served as a conduit for ethics, a key attribute of school culture that promotes respectful relationships between and among students and teachers (Barber, Donnelly, and Rizvi, 2012). Collaboration and caring among and between students and teachers proved to be particularly beneficial in developing the self-efficacy of students with a variety of disabilities during the initial implementation phase of the one to one program.

In “Oceans of Innovation,” Michael Barber, Katelyn Donnelly, and Saad Rizvi (2012) explored school policy, teacher practice, and student achievement and identified three attributes that contribute to a well-educated or well-rounded student within the context of broader set of learning “ethics” in the school’s culture: knowledge, thought, and leadership. Knowledge is the sum of the discrete skills and information that students need to succeed. Thought describes students’ understanding of their own particular learning process and the development of a
“growth mindset”. *Leadership* defines students’ ability to communicate effectively and to work with others. The three factors are positioned within a broader context of ethics, which the authors describe as the development of a culture of respectful interactions between and among teachers and students (Barber, Donnelly, & Rizvi, 2012).

Students, parents, teachers, and building administrators consistently described “Johnson Middle School” as a place where students are supported and where differences in student ability are respected rather than resented. Conversations with parents suggest that this environment of respect had a significant impact on student self-efficacy. Certainly, parents of the students in the study had a unique vantage point on the use of technology given the emphasis on parent involvement in the individualized education plan (IEP) process and the regular use of technology for completing homework and for school/home communication. For example, Isabella’s mother commented on apparent differences between her daughter’s experience at Johnson Middle School and her previous school, located in another town in the region.

I think even in general just being here in (this town) and with smaller classes and more help and support has made a big difference for her as well, but I do think having the Chromebook, and knowing that that's available to her, and she can use it and utilize it on her own and just be independent with it, that's also helped her. And she feels confident showing it to us, and she's proud of it like, "This is my Chromebook". So that gives her a boost too for a kid who doesn't have a lot of self-confidence.

Liam’s father also painted a clear picture of a school community that is working well for his son in its level of support as well as access to technology. He explained, “Coming from (his previous school) to here, there has always been great support. The Chromebook just adds to that.” Ashley’s mother also wondered whether the Chromebook was responsible for an
improvement in her daughter’s attitude toward school or whether it was simply another element of support that was paying dividends:

I don't know really know if that's really the real reason that she's been feeling better. There's so many pieces put in place to support her and breaking down a lot of these assignments and she gets support at school, and all these different things we've put in place to help her. Is it really the Chromebook? I'm not sure… We have different scale of her success, but she has been much more positive this year, and I can't say it's the technology specifically.

Students’ descriptions of the impact of technology use in the school also highlight the individualized support provided by the school and the importance of this support. Noah, a 6th grade student, said that his confidence in school has more to do with the support he received from teachers and staff rather than the availability of technology. For Noah, an increase in his self-efficacy wasn’t about the Chromebook or any other technology; it was about teachers’ support. He explained, “So I feel like if I didn't have that help, then I would be less confident in writing and all that. But I don't really care if I have to type or write as long as I have a little help to make it easier for me.” For Noah, the ability to choose to type or to handwrite was less about accessing the technology, but that teachers would be willing to offer such a choice and provide whatever help he needs to succeed. Ava also appreciated that her teachers frequently give her the option to use her Chromebook. She described this flexibility:

We do that a lot, like in English she'll give us the choice if we want to type or if we want to write, and usually I type because it's just faster and it's just easier because sometimes it hurts your hand if it's a lot to write. And social studies, I know that a lot of the assignments are online like our vocab and our homework. Or at least we have the choice to do it online if want to, which I do a lot because it's also neater and I like that about it…and we have French, we do a lot of stuff online for Google Classroom which I really like, and I always get the choice to type if I want to.
Ava also benefited from the availability of special education paraprofessionals who are available to supervise individual work or provide support:

It’s helpful to go into a different room, and just having the teachers there to help me. Having the aides in the classroom has helped because they're able to help me on the test more if I'm struggling with a question that the teacher can't really explain well enough. They'll go into more detail about it, and when I'm in a different room, all the other kids like me, they'll take a long time on the test too, so I don't really feel pressured to finish because I know that I have all the time that I need to.

The support that Ava and other students received also paid off in terms of Chromebook use with the introduction of the one to one laptop program. Teachers and administrators approached the introduction of one to one technology as an opportunity for students to customize use of the device based on individual needs.

Two specific aspects of the one to one program at Johnson Middle School were also described by students, parents, and teachers as helping to promote a supportive school culture and greater student self-efficacy: the authentic and spontaneous use of technology made possible by one to one access and the empowerment of students that came with responsibility for a specific device.

Technology: authenticity and spontaneity

School administrators and teachers explained that one to one access to technology also helped to support a culture of respectful relationships by supporting teaching that was more authentic, engaging, and responsive to student needs. Traditional models of classroom technology use are more likely to produce teacher resistance because technology “consistently destabilizes the established routines of classroom life including norms of time and space”
THE IMPACT OF A ONE TO ONE LAPTOP PROGRAM

(Somekh, 2008, p. 452). One of the benefits of one to one laptop access is that technology is more able to become part of the established routines rather than being a disruption.

Higher quality teaching with technology was also a significant factor in higher student self-efficacy. Prior to the introduction of the one to one program at the start of the 2015-2016 school year, technology availability often stood between teachers and effective teaching using technology. Teachers relied on several shared carts of Chromebooks, one cart of iPads, and a single computer lab to meet the needs of Johnson’s more than 600 students. Because all teachers shared these resources, it was often difficult for teachers to reserve a cart or the lab on the ideal day or set of days. The result was that teachers used technology less frequently, in a less sophisticated manner, and in some cases, molded instruction to fit the availability of technology.

With the introduction of the one to one program, teachers were able to focus on authentic and purposeful uses of technology that supported essential learning goals rather than on booking and scheduling computer labs or carts of laptops. Technology use became more integrated into day to day classroom activity due to its universal availability, which helped to support student self-efficacy in ways that ad hoc technology use would not. The importance of the freedom to use technology spontaneously was a common theme among teachers in the school. One Social Studies teacher described how Chromebook access had changed the way she teaches geography. If a student has a question about a place or region, she explained, “I can pull up a news video of something that we're talking about or we can look on Google maps to see what a place looks like, the kids can go do their own research on topics that we're talking about.” Another teacher explained, “I don't have to reserve a cart, I don't have to figure out, ‘Do I have enough?’ I can just go with whatever I want. I know the kids are going to have the computers. I can go with it
and plan that way. It's a lot easier.” Another teacher emphasized that universal access to student devices meant that the use of technology was now able to conform to the needs of students and teachers rather than the opposite. One to one access also encouraged collaboration between teachers because access to technology was now uniform. Technology-infused lessons would be transferrable from teacher to teacher without concern that student access to technology would not be uniform.

In fact, school administrators recognized the inherent limits created by shared technology resources in the way technology could be used and had adjusted their expectations for instruction using technology. The assistant principal of the school explained, “Before when you had laptop carts or iPad carts, it became your ‘technology unit’. That is when you used technology. Now the Chromebook is not even seen as technology. It is just a resource that is available in our classroom like other resources.” This change in teachers’ perspective on technology was also evident to the building principal in the ways he saw technology being used on a day to day basis. In particular, he noticed a change in the way technology supported formative assessment. He described seeing classrooms where teachers would be “using the Chromebook multiple times during the day (for formative assessment). You can just do that and just know that whenever it comes up in your unit, you will be ready to use it.” Expectations around technology use have also shifted based on this availability. The administrators recognized that in the past, scheduling challenges would promote “technology for technology’s sake” because the timing of availability wouldn’t line up with broader learning goals. With one to one, there was greater emphasis on sophisticated uses of technology that did more than simply replace non-digital lessons with a digitized counterpart.
In addition, immediate and universal access to a device promoted spontaneity in the use of technology that was impossible in prior years. Ava explained, “(At my previous school) you would have to go to the tech lab to type stuff. But now, you just have to pull out your Chromebook and start typing. So it's sort of easier to do it on a Chromebook.” The end result is that technology is used throughout the school day in nearly every day. Ava also commented on consistent use of technology in her classes: “There's not really a class that we don't use it in, because it relates to everything, it's just really helpful for everything.” Access to the device has also changed the way that information flows around the classroom. Sophia explained that teachers frequently ask students to gather information on a topic independently and report back to the class whereas in the past, technology would only be used for more extensive, time intensive activities. In this way, one to one access promoted student confidence in completing basic research using the Chromebook because it was a more frequent classroom activity.

One to one access was also significant to the times and places students reported doing homework that mirrored the spontaneity of the classroom experience. Ava explained that she now had the confidence and the technology access to bring her Chromebook with her on trips in the car in order to get homework done. Olivia described this flexibility with homework as her favorite thing about her Chromebook. She said, “You can bring it almost everywhere and it's just easier for doing all your homework whenever you want.”

Parents also noticed a shift in the role of technology in the school that paid off in terms of student self-efficacy. For example, Ashley’s mother could clearly sense a change in the way teachers were using technology due to the increase in availability:
It just seems like last year, it was talked about, but what kind of technologies the kids were using was varied based on the home environment and then once the decision was made that everybody should be on a Chromebook and that's going to be their primary device, all the teachers clearly devised their curriculum and all their documentation to fit in that model.

The change in the way technology was being used was also evident to Charlotte’s mother when she reviewed her daughter’s work and how she used technology. She explained, “From what I've seen just so far this year, it does seem like all the teachers are embracing it and knowledgeable about how to use it and how to have the students use it. I think that's a big thing too, because if you gave it to the kids but then the teachers weren't necessarily using it, it might not be as effective.”

Parents also noticed changes in the way that teachers were sharing student work with them. Teachers’ use of digital materials was expanding as a way to capitalize on student access to the Chromebook, and one positive side-effect of the use of digital content was it could now be shared with parents more quickly and easily. In some cases, this was achieved with apps with the goal of parent communication specifically in mind, including Google Classroom and Seesaw. At other times, teachers used their classroom website to share student work, but also as a platform to support students.

Teacher buy-in to a variety of student uses of technology was essential in giving students this sense of empowerment. All of the regular education teachers interviewed described regular use of technology to support learning in the classroom. For some, this use was primarily restricted to note-taking and teacher presentations. For others, including a 7th grade social studies teacher, technology had become an absolutely indispensable component of instruction. She described the ubiquity of her technology use:
We pretty much use them every day. I have them even doing warm-ups instead of having them do a warm-up on a piece of paper, I have them do it in Google Forms. And there's a template that they go to everyday, and it's Monday, Tuesday, Wednesday, Thursday, Friday, little boxes and then they just fill in whatever the day is, and then submit it that way so I can look at it. They use it to write down their homework. We've put all our textbook pages online now too on the PDFs, so I haven't even opened up a textbook. They're all online for them to see, which makes it easier for them. So, we don't send those home. So, when they're studying at home, they can just pull up the PDF of the chapter.

For this teacher, technology was primarily being used to improve the everyday activity of her classroom: warm-up activities, homework, and reading. Full acceptance of technology was in this case derived in the teacher seeing how it could improve ease of access and engagement with class activities that would have taken place normally without the technology.

Despite this shift in many teachers’ practice, there was an uneven adoption of technology-enhanced instruction. Universal access to a common digital device did not overcome the fact the some teachers were reluctant to use technology and others continued to rely on relatively shallow uses of technology such as a multimedia supplement to traditional teacher presentations. This variability was at least partially due to inconsistencies in teacher familiarity and comfort with technology and the inability of professional development to keep up with the pace of technology purchasing. Effective technology professional development needs to be hands-on, which means that it cannot occur until some investment in hardware has taken place such as the use of carts at Johnson Middle Schools. School technology change can actually occur at such a high rate that professional development fails at any point to catch up. Under the best of circumstances, a shift in professional practice based on the universal availability of technology will take time.

*Student ownership*
A second element of school culture that promoted self-efficacy for the students in the study was support for student ownership over learning. In general, many students' “sense of ownership can be enhanced if learning tasks offer some autonomy in the way students study and apply the material” (Lamborn, Newmann, & Wehlage, 1992). In this case, each student’s personal responsibility for the care of the Chromebook helped to inspire more acceptance of personal responsibility for learning as well. This sense of ownership and responsibility that came with the one to one program also helped to promote student self-efficacy as students were successful in managing their device. For example, the Chromebook gave Charlotte an opportunity to be responsible for her own computer that otherwise would not have been offered in her house and to demonstrate her own capabilities. Her mother explained:

She likes that she has her own computer, which she would not otherwise have in our house at this age. So I think for her it makes her feel more mature to have it and to have homework on her own computer and that sort of thing. So in that respect, I think it's helped her confidence.

Isabella’s mother also emphasized the importance of giving her daughter a sense of responsibility for the device – and how Chromebook care quickly became a source of pride for her daughter:

You're messed up for the day without (the Chromebook). So it does give them the beginning sense of responsibility, which I think at sixth grade is a great time to start to learn that. And then making sure its charged every night, where it is every night and to make sure it gets in the backpack every morning, I think its great for them at this age to start to learn that kind of responsibility. So yeah, and I think it gives them a little boost. She's 12, and she can do her whole morning routine and do all that, and this is included in that, and it makes her feel good, so its a positive thing all around and gives them a little extra self confidence.
Ava also found one to one access and the ability to customize her Chromebook to be very important for her comfort with the device:

In the beginning of the year, since last year, we didn't really have an opportunity to really get to know the Chromebook. So now, I know how to use it more and I know little tricks with it, and it feels like my own even though technically, it's not. Because like when you change the background and you have your bookmarks and now I use it a lot more than I did because even if it's just for pleasure when I want to watch TV or listen to music, because I can connect it to a speaker I have which I like to.

Further, one to one access shifted students’ attitude toward technology from stigma to responsibility and pride. Every student interviewed said that they preferred everyone have a common device with other students in comparison to being offered individual technology access, which for many had been the only option in past years. In addition to issues related to special educational status, providing a common device also mitigated other potential sources of difference based on socio-economic status, gender, and parental interest in technology. For Ashley, one to one access was preferable “because it doesn't distract other kids because they're looking at someone else's computer that's better than theirs and it doesn't make other people feel bad 'cause they don't have something like the other kids.” Ashley’s mother described the significance of one to one for students with SLD, in particular:

I think she likes it better this year. The one thing you will find with a child that has any kind of learning disability, they want desperately to be like everybody else. So there's probably some fun with being the only one, the special one having it, but ultimately, she feels much better having the same tools that everyone else has.

Isabella’s mother echoed this sentiment about one to one access vs. a single device for her daughter. She said, “She would have been too singled out and been way too self conscious and I don't think that would have worked.” One to one laptop access addressed both the desire for
students to fit in with their peers, but also their need to have specialized support for their learning.

Teachers described technology professional development as a key ingredient in the successful implementation of the one to one program. Teacher confidence with one to one technology, which was promoted by professional development offerings, also paid dividends for student technology self-efficacy. Johnson Middle School had provided a variety of forms of professional development in the years leading up to the implementation of the one to one program. This included before and after school individual and group training sessions, one full day technology professional development dedicated to technology each year, and frequent presentations to the staff during monthly staff meetings. These sessions not only reviewed the how-to of various technologies, but also emphasized the use of technology to enhance instruction and to provide flexibility to students in terms of how they learn and are assessed. In addition, Johnson Middle has the luxury of a full-time onsite network support technician and a .6 technology integration specialist who are generally able to provide support to teachers as needed.

One special education teacher described the impact of this professional development on her confidence in supporting her students’ technology use: “Because I felt like we had professional days planned for this and (the technology support staff) were always available to help us with the Chromebooks. And then a couple of those faculty meetings where teachers would do things, I went to a couple of those, learned some things on the Chromebook. So I felt like I was equipped when the Chromebooks came out to know what to do with them.”
However, one area of technology preparation that seems deficient was that for paraprofessional staff. Many “paras” commonly worked as classroom aides at the elbow of students with special educational needs, yet were not provided with Chromebooks or Chromebook training. This logistical and budgetary hurdle was detrimental to self-efficacy in that students with in class support were less likely to receive adequate support when struggling with the Chromebook. This was especially troubling to a special education teacher who supported students with emotional and behavioral challenges. She explained, “the paraprofessionals did not get Chromebooks, which I think was huge because they are the people that are right in the classes with the kids all the time and they really needed training so they can help the kids, they should've been versed on what is allowed and what isn't and they weren't even given Chromebooks.”

Technology professional development for teachers also promoted confidence in independent student uses of technology and strengthened a more collaborative and more symbiotic relationship between teachers and students in relationship to technology. The collaborative spirit was evident to parents in the way that their kids were studying and completing work at home. For example, Ava found the ability to e-mail teachers directly to be a privilege that mitigated her tendency to need clarification for homework and other assignments. She said, “Besides classwork and stuff, (the Chromebook) just opened new opportunities because being able to honestly just email my teachers, I really liked that because it really got my grades up. Because at home, I can't call them or anything, but just being able to do that because they always say, "Oh yeah, just email us." And then when you do that, they'll just reply immediately and if it's just a small question about homework or something, then it's really helpful and it's
really boosted my confidence.” The flexibility to communicate with teachers when needed provided Ava with a needed boost in confidence in her ability to overcome challenges that she faced in completing her work.

Ava also saw that teachers’ appreciation for the value of technology led to stronger support for her typing her written material, a major contributor to her comfort with writing. She explained, “I feel like the teachers really like the Chromebooks too. And I feel like they know that we have them for a reason. So if we wanted to type then, it's just a lot easier, because I feel like the teachers think it's a lot easier to type too.”

Charlotte’s mother noted that her daughter's prior year elementary school teacher had helped to introduce Charlotte to the support that technology might offer to her learning. She explained, “Her teacher in fifth grade was very technological and actually also working towards a degree, a higher degree in something with technology and students. So she was very aware of a lot of sort of other ways that kids could use technology, and I do think that really helped (my daughter). I think if she had not been exposed to that through sort of her normal setting, her typical setting, I think we probably would've been requesting an actual assessment to see what other tools she could be given.” In this way, Charlotte’s knowledge of a variety of uses of technology for learning and her own capability to incorporate them made an outside evaluation of how technology might benefit her unnecessary.

The culture of technology acceptance was perhaps most evident in the organic ways that students described how teachers and other students would share Chromebook tips and tricks with one another. This collaborative spirit paid powerful dividends for student self-efficacy as
students were better able to identify helpful Chromebook modifications. Ashley described how her Social Studies teacher helped students to install a text to speech app to help proofread short answers on a test. This app turned into an invaluable resource for Ashley to use for work of all kinds. In fact, teachers’ comfort in offering students choices in how they demonstrated learning relied on this collaborative culture. When given the option to try a new technology, Ashley explained that other students were commonly helpful in trying it out. She said, “Usually, there will be at least one kid in the class that knows how to use it well, so you can usually ask that kid. And if you're the first person that's ever used it, then you have to figure it out. But usually they're pretty self-explanatory and easy to follow.” Ashley also adopted a helpful app for tracking homework, Google Keep, after another student suggested it. Before long, many of her classmates were also using it. Mia also mentioned how she had adopted a new, easier to read font for her word processing after another student had recommended it.

A 6th grade social studies teacher described the importance of this common device for student to student collaboration:

“But I feel like the overall system of one to one is what makes it work. It's like, all the kids are on Classroom, all the kids are using drive, all the kids are using all these apps. Otherwise I feel like she wouldn't be able to take advantage of all the stuff that we do, if it's just a couple of kids that had them.”

This collaboration was especially important because teachers were not yet expert with the Chromebooks themselves. Ashley explained, “Because some teachers, they don't know. They're still new to this too with us, so some of them don't know any other tools to use. That's a big thing, that they don't know what tools to tell us to do, or they're asking other kids in the room,
how do I do this?” At this school, in many cases, student to student collaboration filled the gap created by lack of teacher expertise.

Use of the Chromebook at home for both schoolwork and non-school related activity was also important to student comfort with the device and the culture of collaboration. Isabella’s mother described how having a Spanish-speaking pen pal has encouraged Isabella to explore the Chromebook more. She explained, “We have a sponsored child who lives in another country, and (Isabella) has written her letters, but she got it back and the girl is in Ecuador, and she's only six, but it's all in Spanish. So, (Isabella) found a friend of mine that says that she can go into Google Translate. And (she) is going to write her another letter, but she wants to go on there and read everything that she wants to write and have it translate into Spanish.” Teachers also noted that access to the device at home supported a student comfort level that would be impossible otherwise. As one 6th grade social studies teacher explained, “It does give them time to play with it and get used to it, as opposed to me spending so much time on teaching how to use them. I've already spent a lot of time on it. If they weren't bringing them home, if they weren't trying out some apps at home, then that's even more time they have to spend at school.”

On the other hand, the reliance on technology to communicate with parents did present a particular challenge in that learning management systems such as Google Classroom often do not give parents a platform to follow their children's work. One special education teacher explained,

“The other thing is that I find difficult is that parents cannot access Google classroom because they're not in the network. So, there's no books anymore, there's no textbooks, everything is set on the computer in Google Classroom. So a parent has a hard time with following up with what their student needs to do, especially if the student is one like mine that will not be truthful if they can get out of doing homework.”
In fact, over the summer of 2016, Google Classroom did begin to offer a parent portal to track student assignments perhaps in response to concerns like those above. However, parent access to Google Classroom does not allow parents to see actual student work – only due dates so this remains a logistical hurdle.

Further, digital work did present a challenge for parents in terms of the logistics of viewing student work. Charlotte’s mother explained: “It's harder for me because she's sitting with the computer in front of her. It's easier to pass a piece of paper back and forth than it is for me to be looking over her shoulder onto a computer.”

*School culture and technology leadership*

Despite the overall increase in technology use, there was inconsistency in the use of technology to support students with special education status. One source of this inconsistency was an existing culture of dissonant technology leadership between school and building administration and special education administration. Some special education administrators and teachers at Johnson Middle School relied on technology staff for guidance around technology because they lack technology expertise. Others are skilled users of technology and capitalize on that expertise in their work with students. In some cases, outside evaluations were conducted to address potential uses of assistive technology. In other cases, these evaluations were completed more informally within the system. A 6th grade social studies teacher who teaches in an inclusion classroom commented, “We don't have some real special education and technology leaders who really understand both and push them hard. I've never had someone come to me and be like, ‘I
think this would really help this person. They're struggling with this in your class, I think this on the Chromebook would help.”

In addition, other teachers expressed some reluctance to use technology as often as others, which limited potential increases in self-efficacy. Three of the students specifically mentioned that their English classes tended to rely on handwriting rather than typing assignments, perhaps as a way to prepare for mandated testing. For Noah, the emphasis on handwritten work is a particular burden. “Well we do use the Chromebook to write too, but we mainly use paper. Sometimes I do wish we could because it's easier for me to type it than write it because I have really bad writing. I'm sort of a sloppy writer. So it's easier for me to type, so I can see my words more clearly.” Despite this challenge, Noah does not feel comfortable requesting to type this type of work “because it's never came up on my mind really. It's more like we're writing... She said we're writing, so we're writing.” Noah has remained afraid to question this assumption.

Ava experienced a similar situation in English class. She had developed a careful organization of her digital material using Google Drive and the tendency of her teacher to distribute hardcopy materials proved to be a challenge. In addition, she also felt that handwriting work was mandated and she did not feel comfortable challenging this required. She explained, “They didn't give any clues that we were allowed to type and I was a little scared just to ask because I didn't want them to get mad.”

For at least one other teacher, students' use of technology seemed to conflict with his existing teaching style. Ashley's science teacher commonly asks students to copy text off of
Ashley also had a similar difficulty with reading assignments that were either hardcopy or in some cases distributed in a digital form incompatible with the text to speech application she had installed on her Chromebook. The result was that she was unable to read as quickly and would find herself falling behind the other students when reading in class. In addition, Ashley’s mother explained how Ashley had to convince her teachers to let her record assignments in a digital plan book that she had adopted:

I remember in the beginning of the year, in support they kept telling her that she had to write everything that she needed to do in her agenda, write it in her physical agenda, and that was driving her crazy, because she just wanted to put it all, to have little notes on the Google Docs and that kind of thing.

Ashley eventually won out and she was able to use her own digital system to record work. After a few weeks of doing this on her own, Ashley’s teachers began to recognize that the digital system might actually be a better option for other students as well. Her mother described this transition,

There were definitely conversations she would relate about with the teachers, where she would say, "Well, this is how I want to do it." They would be like, "No, no, no, write it in your agenda," and she was like, "But why? We have these tools here?" And then it seems that everybody sort of, I think they sort of saw that the kids were adopting these technologies in a good way.
Mia struggled with inconsistent use of technology from teacher to teacher because she felt had to be managing work in two entirely separate universes, one paper and one digital. Her science teacher, in particular, rarely used the Chromebook at all in class.

School Culture: Technology Integration

Though the most publicized educational technology is usually on the cutting edge, a second central theme that emerged from my conversations with students, parent, and teachers, was that the most significant positive impact of technology for the self-efficacy of Johnson students with SLD was with everyday learning activities: reading, writing, and executive functioning. The value of technology for bread and butter learning activities was reflected in increases in academic self-efficacy in the pre and post-survey, but was also a consistent theme in interviews. In responses to questions about the impact of one to one access, students, teachers, and parents consistently mentioned benefits derived from steady, regular use of technology in school, which appeared to reflect a culture of technology use integrated in classroom activities.

Benefits for reading, writing, and organization have the potential to be particularly consequential for students with SLD who often confront learning challenges in one or more of these discrete areas (Harwell & Jackson, 2014). For this reason, increased self-efficacy for the students in the study often result from uses of technology that directly compensated for each student’s specific areas of challenge as had been identified by school staff, the student, or parents. Further, tools designed to address specific learning challenges had far-reaching importance for students’ attitudes toward learning. For example, access to the Chromebook was
significant in defining attitude toward homework. Isabel’s mother compared the homework experience for her daughter prior to the one to one program and with one to one access:

“Because I was scribing for her when she was at (her last school), or even in the beginning here before the Chromebook, she would just be so frustrated and crying and all the time. So by having the Chromebook and her being able to just speak right into it, and then just the skills that she's developed over time from September to now, she can navigate through it much, much better now.”

Access to the technology at home was key for students developing the essential skills to be successful. It many cases, it gave the students the time to explore and learn how to use the Chromebook to support their particular needs. For Ashley, the Chromebook was an invaluable tool to explore her passion for horseback riding. This non-academic use proved to be an incredibly important for her skill development. Ashley's mother explained, “She does horseback riding, and so, she will research and read reviews and oh my gosh. She'll give me a dissertation on which shirt she should buy and why and all the pros and cons of it and all that kind of stuff. It's definitely how she uses it.” Isabella’s mother similarly explained that her children have recently been making a case for a family dog and Isabella had used the Chromebook to gather information about different breeds.

Teachers could also see the benefit of this common access in the expectation that students would complete work at home without the potential for technological challenges. A 7th grade English teacher explained, “It's definitely beneficial to have them at home for them to work on rather than leaving it here. If someone doesn't have a computer...I can reach out to them online
too with something on (Google) Classroom. So it's definitely, I think, beneficial from having it in the cart. And I think they like having it better too.”

Students’ use of devices from shared carts prior to the start of the one to one program, presented logistical challenges, in particular for students with SLD. Mia did not like having to remember to return the device to the right place every time her class used it. In addition, the shared devices were more likely to malfunction or to operate slowly. A special education teacher noted how this could be particularly challenging for her students. She said, “Sometimes, if they can't get on the thing that they need to get on like it's slow, it's not working, it's not coming up, those things, that can be very frustrating. But that doesn't that happen often, which I think is a nice thing. Compared to like when we used to have the old carts, and all of those, those often didn't work.” Unreliable technology, in this way, was more detrimental to student self-efficacy than no technology at all.

Access to technology was helpful, but some teachers made the mistake of assuming that the “digital generation” will come equipped with the technological skills necessary for success in a one to one environment. One 6th grade social studies teacher commented:

I think we give them too much credit, for their use of technology. We'd look at kids today, have meetings with teachers and it's technology, technology, technology. They're always using it but they only know how to use it the way that they've used it at home, like video games or like browsing the Internet. They don't know a lot of the terminologies. They don't know how to copy and paste. They don't know when you say "X out of that." They don't what that means. Some of them don't. And then organizing on Drive was just, I don't want to call it a disaster, but it was close to that. We came up with the folder system, tried to do different colors, stuff like that, it was almost too much.

For students with SLD, potential gaps in technology skills can be even more challenging in particular in relation to organization. Nonetheless, a concentrated emphasis
on the use of technology to support specific areas including reading and writing can pay dividends for student learning.

**Reading**

Access to a Chromebook had a clear benefit for students with SLD self-efficacy in relation to reading. Several of the students described that text to speech capability had made them speedier readers while also increasing comprehension. Ashley, for example, said, “It has definitely (helped me to) stay up to pace with the other kids instead of being so far behind, then you're just barely with them...listening to it to me makes it, I can remember so much more than just reading it myself. And it clicks more for me when it's on the Chromebook, usually. For other kids it'll click no matter what, but on paper, not so much for me.” Ava also found that text to speech increased her ability to remain engaged with her academic reading and this improved her working memory of written texts:

I remember for my reading and stuff, I would always go into the audio book and use that because it was really helpful. I'm a pretty slow reader when I'm just on my own because I'll get distracted easily but that just kept me on course and it was easier because it just went faster… You can press the thing and it'll read it to you so it helps you memorize it more, which I use it a lot for more than just class. I remember for drama, for the play, to help me memorize my lines, I put in the script and it would read it for me and then I'd say it, so it was kind of like I had a person to practice with and that made it a lot easier.

For students with social-emotional challenges in addition to SLD, reading was associated with anxiety for those students and in some cases, this anxiety exacerbated challenges related to memory and processing. Text to speech capability helped to break this cycle in many cases. A special education teacher explained this connection:
With a lot of my kids with social-emotional issues, if it's something that they're afraid of or they feel that they can't do it, they tend to not want to try because they don't want to, they get frustrated, or they get worried, or they get upset that they won't be able to do it, and that's a huge issue. So if they're given some of these things that will help them get started with a skill that they're not sure they can do, then it's a very good thing. So I like the text to speech. I think it works quite well, and I love the fact that they can have a book read to them as they follow along, because it makes them more apt to try something they might otherwise be afraid to do.

A 7th grade social studies teacher also recognized that some of his students were much more positive about reading using text to speech.

However, in cases where text to speech capability is not technically feasible or if the teacher does not allow it, digital text can be problematic. Ashley generally prefers to read traditional text rather than on-screen text because of the challenge of extended viewing of the computer screen.

I'll try my best to read on the Chromebook. If I have to I usually zoom it in and then, if, usually I end up actually putting the brightness down 'cause that's usually one of the big distractions for me, and making sure that all the tabs aren't really open so that my eye gets distracted from those, so… It's a little bit easier with the printed version. It's a small change but it does really make a different most of the times, cause it's usually the light that bothers me and the book is just easier. It’s just what works for me the best.

In this case, knowing the technology also means knowing its limitations for each individual student.

Writing

One to one Chromebook access has also had a significant impact on students' self-efficacy in writing. Being able to type more quickly and accurately than handwriting was central to this change. Noah struggled in the past with becoming fatigued with writing after only a short
time. He explained, “I am very slow at writing so my hand gets tired really fast, but when I'm typing, I can finish a sentence way faster than I normally do.” Noah’s handwriting, which was normally quite weak, would become even worse as his hand began to fatigue. This would occasionally lead to uncomfortable interactions with teachers who would struggle to read his writing. Just recently, he explained, he turned in a writing assignment to a teacher and “she was reading it and then she'd be like, 'Okay, what is this word?' And I'd tell her what that word is. And then after a minute of reading, she'd be like, 'Okay. What's this word?' And then I'd say whatever that word was and that's normally how it goes.”

Ashley described a similar experience in 4th grade where teachers would constantly have to ask her to clarify her writing to rewriting work she had already done, which was definitely an upsetting experience. Ashley's mother emphasized the emotional impact of her struggles with writing. Even though technology has helped, writing is still a significant challenge:

She is much faster at typing things in, so writing and, reading and writing is her real challenge, and when you hand her a pencil and you tell her to write a paragraph, it's painful. It takes a long time. And it still takes a long time, it's still a challenge, and then she uses a lot of different tools to put together. They do this little framework kind of thing to help her sort of outline it before she starts writing it and those kinds of things, but ultimately the typing I think helped a bit more. I would say that probably a bit more confident. I think that she's proud of the work she's been doing and she wrote a big essay yesterday and was showing it to me, and so, I would say that it's been a positive, overall.

Isabella’s English teacher encouraged her to use text to speech to proofread writing responses, which she feels has made a big difference in her work. Isabella’s handwriting is so unclear that often cannot read her own. She also struggled with spelling, which was very frustrating for her when writing. Isabella’s mother described the emotional burden
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that came with her daughter’s writing challenges. She would often write for Isabella to try
to lessen the challenge of completing her homework.

Like in the beginning before the Chromebooks came, I was sitting there doing all that for her. I was scribing for her, and I would write notes to the teacher, "FYI, I'm writing it." And they were so supportive like, "No problem, as long as it's her work." Which it was, but I had to write it because she was sobbing, and sobbing, and sobbing, and that doesn't help anybody.

The Chromebook’s speech to text functionality allowed Isabella to write without being tripped up by concerns about her spelling. Her mother explained:

She has such struggles with spelling especially, and just her overall learning disabilities, reading, writing, executive functioning, all those things, but spelling is such an issue for her. Having the Chromebook and being able to do the talk to text is phenomenal, it's huge.

However, for students for whom speech to text was not an appropriate option, effective typing was an essential skill that many students did not possess. Most of the students described improvements in their typing over the school year. Olivia and Liam said this improvement was not the result of specific practice on touch-typing, but rather just from typing so frequently in school. Isabella, on the other hand, explained that she feels typing puts her at a disadvantage to our other students because of her poor typing ability. Ashley's mother, on the other hand, expressed her concern that her daughter was suffering because of her typing inefficiently. She said, "(Students who can't type well) can't get into any kind of groove because they're constantly looking at the keyboard and thinking about all these other things, other then that thought that they're trying to get down on paper."

For Noah, grammatical suggestions from writing on the Chromebook are invaluable to his writing and allow him to manage his writing independently. Whereas in the past he would
turn in writing knowing he would receive extensive corrections from the teacher, he now knows that “if I make a mistake, the computer can just be like, "Here's a mistake," and this is what it looks like spelled correctly. So you can just retype it or click the correction, and it's there.” Other students also mentioned that computer-based writing enables her to edit her writing independently. Sophia said, “Because it's kind of easier than writing it on paper because you can just type it and then it's already there, so you don't have to worry about making any errors or something.” Mia also explained that the autocorrect features in Google Docs had made her writing much more readable for her teachers and for herself when editing prior work.

School Culture: Technology Growth Mindset

Increased student self-efficacy in the one to one program was intimately connected with students’ awareness of their learning challenges and the potential of the Chromebook to address these challenges. The growth of student technology self-efficacy was partially the result of a school culture that emphasized a “growth mindset” in relation to technology. Carol Dweck (2012) explained that individuals with a growth mindset “believe that their most basic abilities can be developed through dedication and hard work – brains and talent are just the starting point. This view creates a love of learning and a resilience that is essential for great accomplishment.” In addition, a growth mindset can help to promote risk taking in student learning, which is especially important for technology use and for students with disabilities (Dweck, 2010). In the case of the one to one laptop program, the development of a technology growth mindset was key in how students capitalized on one to one laptop access.
Students that understood their own particular learning challenges talked about the strategies that helped to address these challenges. These students were also better equipped to find ways that the Chromebook could support their learning. In many cases, the strategies that were discussed previously were most valuable when students fully understood how the technology could meet their unique learning needs. Students with this awareness were more likely to see their SLD as a finite challenge that has the potential to be addressed. For example, Ava described how her attention deficit disorder (ADD) diagnosis made a huge difference in being able to address this challenge.

It's just a lot easier because then in sixth grade is when we found out about the ADD. It's a lot easier now that it's been dealt with because sixth grade, middle school, it was a little rough. You know what to expect and think it was going to be hard and stuff, but it just kind of, I didn't think it was going to be that hard. So once I got on the 504, it really helped, somehow. And especially with the Chromebooks, it really benefited me.

In some cases, a growth mindset means that students recognized that they would sometimes benefit non-digital work or a combination of digital and non-digital content. Charlotte, for example, benefited from having a printed out copy of articles that were assigned for analysis. This allowed her to refer to the reading when answering questions on the Chromebook without having to switch from tab to tab. This need for balance has not been lost in teachers at the school. A 6th grade English teacher explained that she scaled back some digital work to support student needs. She explained, “We’d do assessments on Socrative or we used to use another (app), but we stopped using it. Some kids would say ‘Can I take it on paper?’ because they like to be able to cross answers out, mark up the text, and that's a little harder to do on a Chromebook.”
For many of students, the Chromebook only became a valuable device over time, as the students became more aware of their specific learning challenges and how the Chromebook could compensate for these challenges. In particular, any benefit the Chromebook would provide for reading and writing self-efficacy only developed after students were willing to look at these skills with a more flexible definition that included text to speech technology instead of traditional text reading and typing or using voice typing rather than handwriting.

Text to speech capability was a huge asset in guiding student reading comprehension well beyond that which would occur with traditional reading. The challenge was to convince teachers that listening to words being spoken constituted a valuable form of reading that will make all the difference for some students. Ashley appeared to benefit the most from this type of technology. She said, “Sometimes, when I can have the Chromebook speaking to me, I like it because I do much better when I listen to things. I remember a lot of the details compared to when I don't. When I read it, I pretty much remember none of it and that's a big problem.”

Ashley described how she has struggled for a long time with academic writing. Her mother explained that this challenge is directly connected with issues related to short-term memory. “She'll have a thought, and by the time she would try to get it written down on a piece of paper it would be gone from her head. So for her it's, she just had a big neuropsych exam, so we've learned that she has trouble with her short-term memory, and it's like getting things committed to memory is challenging.” The Chromebook has helped significantly with this difficulty in particular because Ashley’s typing speed and fluency has improved. She is now able to type ideas before they disappear from her mind and her writing speed is now only limited by
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her thoughts rather than the physical process of writing. She explained, “Last year, I would
usually look down at the keys because that's something that I just used to do, but now I haven't
because I've gotten so used to typing on them now that I know where most of the keys are.”

In the past, Ashley’s mother had taken on the responsibility of compensating for Ashley’s
difficulty with written text by reading content to her.

She reads things and it's just hard for her to hold onto what she's read. And her reading
speed is so slow, that only exacerbates that. So, that's why a lot of times if she has a
whole page document for science or social studies, I'll read it and then she can answer the
questions pretty quickly and without any problems. But if she reads it, she has to read it
10 times.

Any benefit from using the Chromebook to write relied on the student understanding the
source of their writing difficulties and the impact of these challenges on their attitudes toward
writing. Mia, Ashley, and Noah, referenced the ability to make quick corrections that made the
Chromebook a better option than hand writing assignments. As Mia explained, “I don't know if a
lot of kids do, but I do because it's easier for me. If I need to erase something then, I can't erase
on the paper. I can just backspace and know what I want to write instead, it's easier for me.” For
Ashley, the sight of a physical sheet of paper produces a visceral reaction that the Chromebook
does not create.

When the paper is in front of me, I start to panic almost because I don't know what to
write, and it's somewhat the same with the Chromebooks, but then I remind myself just to
write, just get something down, and then I can fix it later. And usually that's what helps
me the most, is being able to copy and paste, look at other things on Google Classroom
usually, and look back at notes that we have, and I don't get confused with all the papers
now because there used to be a lot and now there's not.
For other students, including Noah, Isabella, and Charlotte the biggest challenge in writing is penmanship. These students often produce writing that is illegible. Not only is this difficult in terms of demonstrating learning to the teacher, but writing difficult also disrupts the writing flow. Charlotte explained that she frequently has to clarify her words for teachers, but frequently, “I can't even read it” and this makes the writing process intensely frustrating. Isabella’s mother described the intense frustration that often came with the effort of completing writing homework.

She couldn't read her own writing, she couldn't get her thoughts out to be able to write a sentence that she could go back and follow the sentence that she wrote, so then she would lose her ideas. And she's a really smart little girl, but she would get lost, and then she's like, ‘What am I going to write now for my paper? I just lost so much in the translation.’ That she did two hours of work, and then she'd have nothing to show for it. Then that would fall back on us to help her to sit down with her and to write a paper would now it take six hours as opposed to what it would normally take an hour or two hours, because of the whole having to scribe it, transcribe it, figure out, "What did you just write?" Because we wouldn't have a clue, we would have to literally translate what she wrote, and half the time, she didn't even know what she wrote because it was all stuck in her head. And she has great ideas but she couldn't even get it out on paper legibly and thoughtfully to make sense of it to write a paper. But now, that she has the Chromebook, she can spit it out and go back, and look at it, and rewrite it, and it will correct, and correct, and correct, and correct.

Enhanced Engagement

Students with challenges related to attention found the Chromebook to be a valuable asset in remaining engaged in classroom discussion. For Oliva, this is because the Chromebook is right in front of her on her desk and there is a significance difference between following presentations on the Chromebook compared to those on the screen at the front of the class. She explained, “It's just easier instead of having to follow along with the class, you just have it on
your screen.” Liam also prefers to look at presentations and slides on his own Chromebook, including recorded lessons that are self-paced “because we can just look at it ourselves and because we used to have to look at the teacher screen on the white board. But she might move on too fast, but then you could look at it more if you need to, to understand it better, whatever you're looking at.”

The benefits of increased students engagement were perhaps most palpable with homework. Isabella’s mother painted a picture of the homework experience before and after Chromebook distribution.

Definitely, definitely. In the beginning when she didn't have it, it was dreadful and tears all the time. Tears, frustration, ‘I don't want to do homework, I don't want to...’ And hours, hours. Now, it's much quicker. Now she does her math. She's good at math, all my kids are good at math because my husband's a structural engineer, so they have his math brain which is great. But anything that she has to do on the Chrome, her English or whatever, even science, is, she does it much faster. And she's like, ‘Ah. I can do this.’ I definitely think that's helped her. And she feels confident showing it to us, and she's proud of it like, ‘This is my Chromebook’. So that gives her a boost too for a kid who doesn't have a lot of self-confidence. It just gives her that little extra edge too even if it's whatever it is for her it's nice too. And then she shares it with her brother, and she can show him how to use it.

Though the Chromebooks did have a powerful effect on student engagement in the first year of the program, these benefits may be temporary as the novelty of digital access wears off. Charlotte’s mother has already experienced this as the school year progressed.

Well, I think getting the Chromebooks at the beginning of the year was very motivating for the kids, and just having it, setting it up at home. I do think there was a certain amount of excitement that they had their own computer. Even though it was doing homework, I do think that was somewhat motivating. As the year's gone on, I don't see her preferring to do her homework if it's on the computer versus not.
Executive Functioning

Access to a Chromebook access also had a significant impact on the self-efficacy of students with challenges related to executive functioning, including organization. As a 7th grade social studies teacher explained, “I know it helps a lot of kids having everything in one place because some of them with the executive functioning that are so disorganized, they can't keep a paper from day to day. But with a Chromebook, if they put everything into their Google Classroom, they have it. They always have it.”

Ava, for example, has become very skilled with using Google Drive to manage homework and projects to the point of installing the Drive app for even quicker access. She explained:

On my phone I have the Drive app, so then if I want to do something then it will go to Chromebook and the Chromebook's really easy. I could just bring it to school and it'll be on my Chromebook and I don't have to worry about it, and it's not like I'd forget it because I'm just on there and it's easy because it kind of just keeps everything in one place, so if I have multiple homework assignments that are on the Chromebook, I don't have to make sure that I don't forget them because that happened a lot before the Chromebook. I had so much stuff that I forgot it at home.

This was not an overnight process. In fact, Ava began the year without a way to organize her digital files. It was only after she became motivated to do better in school that she took a close look at her organization – both digital and traditional:

In the beginning of the year, I wasn't really trying on my schoolwork, but now I really want to shoot for good grades and I really want to succeed, like get on the honor roll. So now I'm really trying to organize and also, I just redid my room. Everything was chaos in it before but now it's better because it's all organized, which I like.
Mia had turned to Google Keep, a digital sticky note application to record assignments.

Liam liked that Google Docs was always saving so that he would have no fear of losing work. Both Isabella and Charlotte’s mother emphasized the value in being able to submit completed work immediately with the Chromebook. In the past, both students had situations where they had completed work, but had lost it between home, the locker, and the classroom. In this case, the Chromebook was helpful in alleviating the frustration that came with work that was done, but not given credit. Charlotte’s mother described this benefit of digital access:

She tends to sometimes forget her homework in her locker or in a folder that she doesn't have with her in the classroom, which some teachers end up marking as a zero even if she's done the work. So at least with the submit feature, when she doesn't have to remember that next step of turning in the actual assignment by walking it into the teacher, and I also think it's helped because a couple of times this year, whether it was snow days or just things came up where something might have been due and the teacher said you can have until Sunday to do it but you have to submit it by Sunday night. It's been nice on those times when they needed a little bit of extra time, that they can still complete the work at home and submit it without, again, relying on bringing it in to school late.

Despite the clear value of the Chromebook in allowing students to manage work, students and parents also described several drawbacks. Ashley’s mother reported that last year Ashley was often unable to find digital work in Google Drive resulting in the same sort of frustration with organization she had experienced in the non-digital environment. Ashley also occasionally forgets to charge her Chromebook at night. She explained, “Usually, if my backpack's in my room, then it'll remind me ‘Oh, my Chromebook needs to be charged.’ But when it's somewhere else, I just forget or I'll come to school and think, ‘Okay, maybe I can get today out of it, let's hope.’ Thought Ashley seemed to treat this issue with a sense of humor, her mother reported that remembering to charge the Chromebook was actually a significant source of stress. She said, “I think she forgot her charger with one day she was saying her Chromebook was dead at school
and teacher's giving her a hard time about it... She's a high stress kid, so she's a panicker. So it's always worse before it gets better. So yeah, the first time she forgot and she was a complete stress ball and was all upset about it, but once she's through it then she's fine.”

Further, a special education teacher reported that her students with organizational difficulties often forget to charge their Chromebook at home and sometimes forget to bring the Chromebook to class after a trip to their locker. For Noah, the primary challenge is managing the Chromebook in class to protect it from damage. He explained, “Once in a while when I'm about to turn I might drop my Chromebook, but then I normally catch it. And it hasn't cracked yet.” This fear of physical damage has actually led Noah to rely on a paper assignment to insure that a broken Chromebook does not impede his ability to get his work done.

In addition, three of the students reported that their Chromebook was an occasional distraction from learning during the school year. This was usually due to access to websites, music, and other content that does not support learning. At other times, the technology itself distracted from the learning process. “Noah” explained why he generally preferred when the teacher required that everyone hand-write assignments: “Like you're trying to write and then you hear someone typing and I feel like if you have trouble writing, I think you should choose to write instead of type 'cause it would make it... You'll get used to actually writing.” Ava also found that recording assignments using a traditional agenda was more effective for her. She said, “Well, for starters, I have an agenda, so I don't write my stuff on the Chromebook for homework because for me it's just easier because I can just open up to it and it's like right there.”
In addition, Ashley finds reading on the Chromebook to be a particular challenge, partially because of the strain of the digital screen, but also because of distractibility. She said, “When we have to read on the Chromebooks, I can't really see it all that well. I usually end up putting the brightness down because that's usually one of the big distractions for me, and making sure that all the tabs aren't really open so that my eye gets distracted from those.”

Distractibility was also a problem for students who use the Chromebook to listen to music while doing work. For example, Mia reported that her math teacher had given students the option to listen to music using ear buds during quiet work time. Mia enjoyed listening to her favorite music initially, but stopped after she realized that her work was suffering. This experience was echoed by a special education teacher in reference to music, videos, and video games:

I do see the kids abusing it frequently. I see the kids abusing it via videos, if they are allowed to use music. I think that it's a distraction and it also wastes a lot of time, because what they like to do is go on the music, and then they take some 10 minutes finding the song they like and before you know it, with a 60-minute class, they've wasted a lot of their time that they needed to be working. I see that a lot and I also see kids abusing it. Well, they will go on videos when you are not looking at them. And video games, so the computer is a good thing but there's going to be some way to block every single one of those video games because kids are so into it and I see kids on video games all day long.

Another special education teacher explained that some students are unable to resist the urge to allow the music to become a distraction from their work. Others benefit significantly from the sensory stimulation of background music while working.

All students and in particular those with learning challenges would have benefited from additional training prior to receiving the Chromebooks. This could include ways to customize the
Chromebook to fit individual learning needs, but also strategies for managing distractibility. Ashley felt that “some kids were really confused when they got them because they had no clue what to do with them, but then other people were able to show them what to do.” A 6th grade teacher emphasized that this training should also focus on searching for information.

**Student Leadership**

For students with SLD, technology has the potential to grow from a tool employed to compensate for learning challenges into a source of leadership in the classroom by promoting high self-efficacy. The first step in students with SLD to become leaders around technology is to develop a comfort with self-advocacy. For Ashley, this confidence was expressed in her use of technology to support her work without explicit permission given by the teacher.

They all seem to know about it now, and I usually don't care, I just take it out and do it anyway. And if they were really bothered by it, I bet they would come over and tell me not to use it. But they haven't done any of that.

Charlotte’s mother emphasized use of the Chromebook at home as key to Charlotte’s confidence. In particular, use of e-mail to communicate with teachers from home was essential.

All the kids having their own email account through the school and then also having the access with the Chromebook encourages independence because I know (Charlotte) has been able to… use the Chromebook and email a teacher with a question has encouraged her to be more independent.

Online discussions and pre-recorded presentations have also helped students to overcome anxiety that would otherwise be restricting. For example, Isabella would typically be very reluctant to contribute to a class discussion for fear of embarrassment or negative reactions from
classmates. As her mother explained, “She was afraid because if it was the wrong answer she was going to get laughed at, that's the biggest thing.”

Ashley had similar fears, though in her case the anxiety was more linked with past experiences with reactions from teachers when she has been unable to contribute when called on in class. She described, “I'm usually confused at that point, and I say, ‘I don't have anything to say, sorry.’ And then they get mad at me.” Ava explained that she is normally not very shy, but becomes uncomfortable in class and tends not to contribute to traditional class discussions.

A variety of online discussion platforms successfully alleviated student anxiety and leveled the playing field in terms of student participation. Google Classroom is commonly used at Johnson Middle School to organize student work and it is also allows for online discussions. One special education teacher described how applications like Google Classroom can empower students to have a voice that would otherwise not be heard. She explained, “I think that it gives them voice where most kids will be quiet as oppose to, probably just sit and be afraid to ask a question, something like that.” A Social Studies teacher described the power of presentations that are recorded in comparison to traditional presentations given at the front of the classroom:

There are definitely kids who would just freeze in front of the class. Now that they're making a video with a small group, you see them act way different in front of that video. It also gives them ways to maybe work in a group and not be in the video. So I definitely saw kids more open to participate in projects because of the technology.

Ashley found that online discussions were preferable because everyone’s comment was given equal weight unlike in-class discussions where she said that boys tended to dominate the conversation. She also particularly enjoyed the use of an app, Verso, that allows students to contribute to an online discussion in which each student’s identity is hidden except for the
teacher. Ashley’s Social Studies teacher described the value of this app for all of her students, but in particular for Ashley:

We did a Presidential Election debate on Verso and the kids really liked it. They liked being anonymous. And I think for someone like (Ashley), who's a little bit more reserved, doesn't really speak a lot in class and doesn't really participate or volunteer, I think she definitely found a way to participate because she knew it was anonymous and could comment on other responses. I can sense a tense presence and she rarely, rarely, rarely, participates in class, and looks nervous if you look like you're going to call on her. So something anonymous like that, I think, works in her favor.

Ava and Mia also specifically referenced the Verso app and how it worked in concert with a traditional “fish bowl,” discussion with an inner circle that would lead the discussion and an outer circle that records information from the inner circle. Ava explained, “The teachers can ask a specific question on there that they put for a lesson. And it will relate to what the inner circle's talking about. So then you have a box that you fill out and then you can post it. It's with numbers so it's anonymous, but you can see everybody else's posts. You can read them and you comment and you can like them, other people's, to kind of get an idea of what other people think, which I like because it's anonymous.

In many cases, the students not only found that the Chromebook helped to level the playing field, it also gave them a platform for leadership among other students. Ashley described how she found the Chromebook to be a platform for making connections with other students that was impossible with traditional academics.

I'm not able to show other kids a lot of stuff, so that was the one thing I was able to do. That was something that I could show them. Sometimes I feel like I'm just closed off from the other kids sometimes, so just with the reading disability and stuff, so that's something that I was able to do with the other kids.
Noah was inspired by Chromebook access to embrace video as a platform for expressing himself. He explained, “After like the third day, I started going Internet crazy because I'm starting a YouTube channel and I'm like writing scripts for it, and next year, my YouTube channel is going to be a thing.”

Isabella’s mother experienced the power of her daughter’s comfort with the Chromebook first-hand.

She knows so much that she was showing me stuff on my laptop, and I'm like, "Good for you," because I don't know how to do that. I'm not very computer savvy. But I can get by, but she was like, "Mom, watch this. Do this, this, and this." I'm like, "Wow, that's cool." So, she's definitely learning a lot and I asked her... She woke up just before I left and told her I was meeting with you, and she said, "Yeah, I'm much better at it now than I was in the beginning and I'm more comfortable with it." And she likes it a lot, so she's very, very happy that she has it.

However, for some students, use of the Chromebook followed prior patterns of feeling inadequate in comparison to other students. Noah, explained, “I think I'm sort of average with everyone else on the Chromebooks. I might be a little slower, having trouble finding out where to go on there for a website that our teacher applied for us.” Nonetheless, Noah felt comfortable asking other students for help and on occasion if he had found something first, he was happy to share it with other students.

Digital work in the classroom also frequently served as a bridge between students so that the Chromebook actually served as a platform for social interaction. One special education teacher explained this phenomenon:

It's attitude and it's a behavior where it's become more social. So when you're working on a computer next to a person doing the same assignment, I find a lot of conversation, more so than if they were doing paper and pencil. I don't know if it's that less concentration is
needed. Even if you go into a classroom and they're all sitting in groups and they all have their Chromebooks, there's a lot more conversation going on. Whether or not it has to do with the subject matter or whether or not it's something else, but I think this brings out more communication with the individuals that are together.
CHAPTER 5: Discussion

This study examined the experiences of nine middle school students with specific learning disabilities as they navigated the first year of a one to one laptop program in order to evaluate the impact of technology on student self-efficacy. Through interviews with the students and their parents and teachers, pre and post survey data, and reviews of online work, it is clear that one to one technology has the potential to support increased student self-efficacy in particular when technology use builds on an existing school culture of technology acceptance.

The study was oriented by a series of guiding questions that are worth considering individually.

- How do middle school students with specific learning disabilities feel that 1:1 technology influences their academic experience?

In many cases, one to one access allowed students to manage day to day academic work in new and more efficient ways that promoted higher self-efficacy. First, the Chromebook enabled students to read and write using modifications that matched student strengths. Text to speech allowed some students to read more quickly and with stronger comprehension. Other students and their parents found that the opportunity to type and to use speech to text functionality instead of handwriting was a real game-changer in their academic experience. Homework, in particular, shifted from an emotionally draining experience for students and parents. By providing multiple avenues to read and write, one to one access enabled students to take more personal responsibility for homework completion, which helped to promote higher academic self-efficacy overall.
In addition, one to one Chromebook access value was not only in that it helped to level the playing field of academic work, but in its sociability, the potential for the tool to support “shared purpose and social interactions among group members” (Barab et. al., 2001, p. 83). Chromebooks in the classroom helped to promote collaboration and communication among students and between students and teachers, which promoted greater social self-efficacy. For many students, the Chromebook became a comfortable platform for collaborating with classmates on assignments and working with teachers to edit work. Consistent with activity theory, the impact of the Chromebook was powerful in the way it mediated relationships between students and teachers, students and parents, and students with one another (Murphy & Rodriguez-Manzanares, 2008).

These overall benefits in terms of academic work were at times challenged by issues related to distractibility. Several students, parents, and teachers described how ubiquitous digital access often made it more difficult for students to complete work in a timely fashion. At times, assignments would take much longer to complete because students lost focus on the task at hand, which weakened student self-efficacy in terms of work completion. Overall, however, students felt that one to one access had an overall positive impact on their academic experience.

○ What characteristics of 1:1 programs present particular challenges or opportunities for students with learning disabilities?

Several characteristics of the one to one program at Johnson Middle Schools were particular beneficial for students in terms of greater self-efficacy. The students in the study found that the Chromebook was an important asset in managing digital schoolwork, in particular because students had access to the device at home and school. At home access was helpful for
several reasons. First, students were able to explore and implement device customizations at both home and school and have access to them at all times. This made it more likely that students would master the use of an adaptive technology such as speech to text because they were able to have consistent access to it. The Chromebook’s cloud-based OS blurs the line between the device hardware and software by giving students the flexibility to explore software modifications to the device without the need for any installation media. Second, students reported that it was very efficient to be able to easily continue work that was started at school. This alleviated the challenge of using portable media such as a flash drive to transport work. Finally, easy at home access to work from the school day gave parents a digital window into students school life that was previously obscured.

- How do middle school students with specific learning disabilities manage digital schoolwork?

The students with SLD in the study employed the same tools as other students to manage their schoolwork, often relying on conversations with other students to identify and select from several options. There were several choices for challenges related to executive functioning and tracking schoolwork including Google Calendar, a cloud-based calendar program, Google Keep, a digital reminder note organizer, and My Homework, an assignment tracker. In addition, students also employed a number of assistive extensions that supported their digital experience in the one to one laptop environment. Students used Bookshare and Read&Write for Chrome for text to speech capability, Google Docs for speech to text, and Ginger for grammar checking.

Further, several students expressed a greater deal of comfort with digital classroom discussions in comparison to traditional discussions. Students felt great self-efficacy with time to
view other student responses, plan their own digital posts, and to present ideas without the anxiety inherent with speaking in front of the classroom.

- Do middle school students with learning disabilities find that a 1:1 program can help to create a more equitable learning environment?

Students described a variety of situations where the Chromebook served as a platform to level the playing field. First, text to speech and speech to text capability allowed students with SLD in reading and writing to demonstrate knowledge and mastery in a manner equivalent to students without SLD. Second, the Chromebook’s organizational tools were beneficial in overcoming challenges related to executive functioning by helping to organize schoolwork, develop digital reminders, and make stronger home/school connections. Finally, students found that digital discussions alleviated the extreme anxiety commonly faced by students with SLD in sharing in the classroom.

In fact, for some students, the Chromebook even became a vehicle for taking on a leadership role in the classroom as students with SLD developed mastery with Chromebook functions that could be beneficial to all students. By developing a culture of collaboration around technology, Johnson Middle School was able to create the conditions in which students with SLD could share their expertise and receive valuable suggestions from peers and teachers.

Critical Conditions

It is important to recognize the experience of nine students in one middle school is not necessarily transferrable to other students, schools, and school systems. However, there would be value in any school to consider the connections between school culture, technology, and student
self-efficacy. In their analysis of changing trends in school information technologies, Bigum and Kenway (2005) identify five principles that support effective use of technology, which are consistent with these themes. First, schools must become “communities of learners and knowers” by approaching technology from three dimensions: operational, cultural, and critical. The operational dimension focuses on the skills necessary to be successful with technology. The cultural dimension relies on school administrators, teachers, and students seeing technology as more than just an interesting aside to the every day work of learning. Finally, the critical dimension requires that the school community become comfortable enough with technology to be able to question assumptions about its value.

Second and most controversially, schools must put “teachers first” in terms of gaining comfort with technology. This lies in contrast to the traditional attitude about school technology that student access to technology can supersede teacher use. However, Bigum and Kenway argue that effective student use of technology can only follow comfort among teachers. Third, technology must be understood in the context of “complementarity” or related skills that will allow teachers and students to be successful users of the technology. Fourth, technology should be evaluated for its “workability” or its ability to improve the work conditions of teachers and students. Finally, “equity” should remain a central goal when applying technological resources to a school environment.

Consistent with an existing school culture of mutual respect among students and teachers and the integration of technology in everyday learning, these principles helped to enable the one to one laptop program at Johnson Middle School to promote the self-efficacy of students with learning disabilities. In fact, sustainable benefits of this one to one laptop program appeared to
depend on maintaining fidelity to these ideas before, during, and after the implementation of a one to one program.

Survey and interview data suggest several key factors, or critical conditions, that helped to promote the self-efficacy of the students studied. First and foremost was the presence of a supportive school culture that gave students a sense of comfort and well-being with and without technology. In fact, the impact of the one to one laptop program at Johnson Middle School on student self-efficacy had as much to do with school culture as it did with access to technology. Students with SLD at Johnson Middle School and their parents consistently described a school environment that was supportive of their learning needs, where teachers and administrators would accept common responsibility for their success. This care and attention clearly paid off when the one to one program was implemented.

In addition, an emphasis on every day uses of technology proved to be invaluable in promoting technology acceptance – and student self-efficacy. Technology was often used in ways that students and teachers could see its value for regular classroom activities, rather than as an unneeded extravagance. Student self-efficacy benefited from this regular use of technology and its direct tangible benefit for common activities such as reading and writing.

The one to one program, in particular, helped to promote self-efficacy in that it enabled students to gain a sense of ownership over the technology that would be much more difficult in a traditional technology program. By navigating the process of using the same technology at home, showing responsibility for charging and caring for the Chromebook, and bringing it school, students saw the device as an individual asset to their learning that each student could control.
Further, students with SLD often gained additional experience with the one to one technology in the process of identifying supportive or assistive technologies. Students with SLD were able to use this experience to take on leadership roles around technology in the classroom.
Findings in this dissertation suggest the presence of the following critical conditions that helped to promote student self-efficacy:

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Critical condition 1: Creating a community of learners and knowers – Culture of collaboration

Johnson Middle School approached the challenge of the one to one implementation by addressing the three dimensions identified by Bigum and Kenway (2005): operational, cultural, and critical. The operational dimension was addressed by insuring a base level of skills among students and teachers. This was important for several reasons. First, it allowed teachers to develop lessons that require student technology use without worrying that students would not
have the basic technology skills to complete the assignment. Second, students and teachers
would have a common technology vocabulary. Third, providing a foundation of skills would
insure that students who arrived from out of district without technology experience would have a
broad source of expertise to rely on.

The cultural dimension was addressed through the collaboration of regular education and
special education teachers and technology staff, which appeared to be a common experience in
the school. In general, technology has the potential to be a barrier between regular education and
special education teachers. This is partially because teachers’ primary focus is usually on uses of
technology that enrich the experience of all students while special education staff tend to be
more focused on uses of technology that help to level the playing field by supporting students
with unique needs. The tension between enrichment and equity has the potential to limit the
ability of a one to one program to succeed in either way. However, Johnson Middle School was
generally able to address this tension, partially because it had dedicated technology integration
staff that was charged with insuring that technology was serving both missions and because
principles of universal design for learning (UDL) helped to guide curriculum design.

The makeup of the teaching staff at Johnson also helped to strengthen a culture of
collaboration around technology. The assistant principal explained that though the school had a
mix of technology comfort levels, there was a growing acceptance of technology by just about
everyone:

Like with anything new, you have innovators, the people who bring the idea to you, early
adopters who think the stuff the innovators are doing is cool, late adopters, and then the
individuals who are anti, say "I am not doing it". I think we had a critical mass of
innovators and early adopters and technology pushing them and we had some late
adopters who were hesitant, but now it is has shifted. Our late adopters are even on board. If we took it away, it so ingrained that it would challenge even those hesitant late adopters.

The critical dimension of the culture was supported by giving voice to teacher, parent, and student concerns about overuse of technology. Parents and teachers had expressed concerns about the potential downsides to the one to one program including overuse, distractibility, and cyberbullying. Prior to the one to one program, school administrators clearly expressed that the school would take an active approach to addressing these issues. First, the school would continue to promote non-digital learning and monitor Chromebook use to insure that students would maintain a balance of traditional and digital learning. Second, to address distractibility, the school would provide software that would allow active content filtering during the school day and at home, and another platform to allow teachers to both push content to student devices and also restrict student Chromebook activity. Finally, students would be trained to understand the dangers of cyberbullying from both the perspective of a victim and a potential perpetrator and to know what to do if this type of behavior was observed.

The product of these efforts was a school culture that promoted a wise use of technology that supports student learning, but is not omnipresent. Above all, the school put student learning above technology for technology’s sake.

Critical condition 2: Teachers First – Phased implementation

One of the great paradoxes in school technology integration is that teacher comfort with technology often relies on the availability of technology resources and training, but that school systems are reluctant to invest in technology unless teachers are prepared to use it. This paradox is similar to that described by Thomas Hatch (2001) in his deconstruction of school change
processes in the era of state and federal funding that is tied to policy mandates. Hatch points out that “it takes capacity to build capacity” such that school systems are reluctant to overload teachers with additional new initiatives, but generally rely on the funds that come with the introduction of such programs. Similarly, it takes technology capacity in terms of resources to build technology capacity in the form of teacher technology expertise.

In fact, investments in technology also have the potential to be counterproductive if teachers feel that innovation is being pushed from the top down or if technology use is mandated despite feelings of resistance. A culture of collaboration around technology requires that teachers see technology as a valuable asset rather than an additional burden. Students’ descriptions of teacher use of technology at Johnson Middle School suggested that teachers were open to a variety of uses of technology to support student learning.

One way to overcome the paradox of needing capacity to build capacity is to promote technology use that propagates organically. Johnson Middle School took this by promoting teachers and school administrators to “lead from the middle” on technology (Hargreaves & Ainscow, 2015). Rather than implementing technology by imprimatur, Johnson focused on identifying key technologies and then establishing pilot groups of classroom teachers that would use the technology, identify strengths and weaknesses, and provide feedback on whether the technology was worthy of a broader investment of time and resources. Once a technology was ready to be implemented more widely, teachers were empowered to present to other teachers in department and staff meetings. This would allow the potential benefits of using the technology to propagate organically. Before long, teachers would be seeking out support and guidance for that particular technology.
In addition, prior to the implementation one to one laptop program, technology was introduced in phases to insure that teachers were able to build on prior knowledge and not develop an adversarial relationship with technology. One key element of this gradual build-up was the introduction of G-mail and Google Drive years earlier. These software platforms for e-mail and document sharing respectively are largely device-agnostic, which meant that teachers could start using them without confronting unfamiliar hardware. Nonetheless, skill with G-mail and Google Drive was invaluable when teachers were introduced to the Chromebooks as a learning tool and it made the interface of the Chromebook more familiar.

Critical condition 3: Workability – Professional development for students

The students in this study were often their own best advocates for using technology to support their learning. In some cases, this consisted of students asking teachers for permission to use technology to support reading, writing, or another activity. In other cases, students were able to identify helpful technologies and implement them independently. Overall, technology was often most effective in promoting student self-efficacy when its use was initiated by the students themselves. This requires that students have a foundation of technology skills that are support learning directly and give students the confidence to advocate for their own technology use.

One to one programs are particularly well-suited to the development of student technological confidence and expertise. Home access to a familiar device was frequently mentioned by students and parents as a key factor in promoting self-efficacy. In addition to implementing one to one programs, schools can do several things to promote student self-sufficiency with technology. First, technology skills should be developed early – when students are starting to gain an interest in cell phones, tablets, and computers. High school is too late to
introduce students to important concepts in computer science and technological literacy. 3rd and 4th graders are using their parents’ technology at home. That is when schools need to promote appropriate use. Second, like with math or reading, technology literacy is an incremental skill. It is therefore essential that districts develop technology curricula that build from grade to grade. Finally, schools must place an emphasis on technology use that is integrated with regular academic areas. This requires that school leaders resist the urge to relegate technology to scheduled computer classes, which will not work. Technology is only authentic when it is used to complement other learning goals.

The end result of a well-prepared student body is that students are their own best resource and the best resource for their peers. Johnson Middle School’s students benefited from a culture of collaboration among students and in many cases, technology was the key conduit for this collaboration.

Critical condition 4: Workability – Professional development for teachers

Johnson Middle School promoted the workability of the one to one program by providing a range of technology professional development opportunities. This took a variety of forms including a dedicated professional development day, before and after school help sessions, and in-classroom support provided on demand. In addition, by providing teachers with a Chromebook prior to the launch of the one to one program, the school was able to emphasize hands-on professional development. Further, training focused on technology in the context of classroom instruction rather than being promoted in a vacuum.

In addition, school leaders utilized the SAMR model (see figure 2) to promote technology uses across a range of levels of sophistication (Puente, 2013). The SAMR model defines a
range of uses of technology in the classroom, and that teachers should seek to utilize technology in ways that fall throughout this spectrum. The SAMR model divides technology uses into four categories: Substitution, Augmentation, Modification and Redefinition. With Substitution, digital technology simply replaces non-digital learning. Augmentation consists of digital technology that offers a functional improvement without making a significant change such as an online quiz. Modification defines technology that offers a significant improvement to an existing lesson. Finally, Redefinition defines uses of technology that allow for learning activities that could not otherwise exist.

Figure 2 (Puentadura, 2009)

There is value in uses of technology throughout the SAMR spectrum, but by acknowledging the place of current uses of technology, teachers were better able to explore activities that would capitalize on the full value of access to the one to one Chromebook.

Critical condition 5: Complementarity – Technology growth mindset
Acceptance of technology was an element of student learning relied on a common acceptance of a “technology growth mindset” in the district. A growth mindset suggests that capability to learn a particular skill is not fixed, but that individuals can increase their potential to learn by strengthening the power of the connections made in their brain (Dweck, 2012). This growth mindset was essential for successful uses of technology by students with disabilities in the district. In general, there is a danger that students with learning disabilities can be over-accommodated with technology to the point of producing an attitude of “learned helplessness” (Valås, 2001). It is essential that one to one technology be introduced in such a fashion that it promotes students self-sufficiency in order to support student motivation and self-efficacy.

In addition, as much as a school system may endeavor to slow the pace of technology, it is always changing. In the past, schools could lock the technology status quo within school walls despite the pace of change outside the school walls. However, the expansion of cloud computing, online tools, and Internet research have made this strategy impotent. The alternative is to accept that there is no such thing as “know how the technology works,” but instead to develop a philosophy that being prepared for the pace of technology change is about mindset, not about discrete skills.

Johnson students arrive with a toolbox of metacognition skills, which is presented at the district upper elementary school as “habits of mind” (Costa & Kallick, 2000). Habits of mind are strategies to address situations where the answers are not clear including persistence, flexibility, and applying existing knowledge to new situations. This was helpful for incoming 6th graders who were fully immersed in the Chromebook one to one program within a month of the start of the school year.
THE IMPACT OF A ONE TO ONE LAPTOP PROGRAM

In addition, teaching with technology was commonly conceived as a subdomain of effective teaching in general. For Johnson teachers, great teaching was about student engagement, critical thinking, and collaboration regardless of whether technology was used at all. This emphasis on technology as a partner with effective teaching reflected an understanding of the role of technology consistent with the concept of technology pedagogical content knowledge (TPCK) (Mishra & Koehler, 2006). TPCK is an extension of Shulman’s (1986) definition of pedagogical content knowledge (PCK), which defined effective teaching as lying at the intersection of expertise with pedagogy and content knowledge. TPCK adds technology as a third element, not as a separate domain, but as an additional area that requires teacher expertise.

Critical condition 6: Equity – Universal Design for Learning (UDL) and student leadership

Curriculum design played a key role in creating an accepting culture that promoted successful use of technology. Curriculum development in the Johnson School’s district had a long-standing tradition of emphasizing concepts related to Universal Design for Learning (UDL). UDL is a philosophy of curriculum development that emphasizes flexibility in teaching and learning in response to the varying needs and strengths that students possess (Rose & Meyer, 2002). UDL addresses this need for flexibility within three guidelines. Guideline I, Multiple Means of Representation, suggests that students should have a menu of options for access content. Guideline II, Multiple Means of Action and Expression, emphasizes flexibility in the ways that students demonstrate their learning. Guideline III, Multiple Means of Engagement, calls for teachers to use a variety of strategies and resources to gain and maintain student interest and to promote student organization and self-regulation (Cast, 2011).
The use of UDL allowed for a level of teacher comfort with one to one access that would not have been possible otherwise. Teachers were now able to consider a variety of digital tools that would help students to meet the same learning goal. However, the school principal said that he was somewhat reluctant to identify Universal Design for Learning explicitly because of a potential backlash against a perceived additional demand on teachers’ time. He explained:

(UDL) hasn’t been a specific focus for the entire school partly strategically. Even though philosophies behind either it are coming in without teachers knowing or with some teachers or leaders knowing that it is an aspect of UDL but without using the UDL terminology. The fear is that it would feel like another initiative that we would be taking on. There may be a time when we do introduce it because it is a paradigm that we believe in and embrace.

To a certain extent, this covert leadership in terms of educational philosophy has empowered the ideas of universal design for learning in a way that would have been very difficult in a more overt way.

In addition, many students turned their initial use of technology as an assistive resource into a source of leadership. This development was driven by students’ technological expertise and confidence in their knowledge of the Chromebook’s functionality. Universal access in the one to one program gave a platform for students to share this knowledge with other students.

Limitations of the Study

Limitations in the research should be considered in examining the findings of this study. First, this study was limited to nine students with SLD in one particular middle school. The experiences of this group of students should not be assumed to represent that of students with SLD, in general. Second, the self-efficacy survey is problematic in that it did not include a control group in order to compare effects between the students in the study and students without
an SLD diagnosis or students outside of the one to one laptop program. For that reason, it is not
possible to conclude that the increase in self-efficacy is unique to this group of students. Finally,
there are issues to consider in the positionality of the author. Because I am an employee at the
school where research was conducted, it is reasonable to question whether the study reflected an
insider bias.

Conclusion

This study examined the experience of nine students with specific learning disabilities as they
navigated the first year of a one to one laptop program at a middle school in eastern
Massachusetts. Each student found different challenges and opportunities that came with one to
one laptop access and their varied experiences suggest certain critical conditions around
technology use promoted higher student self-efficacy. Most importantly, Johnson Middle School
had an existing culture of respect for students and a philosophy of respecting each student as an
individual with unique learning needs. Aspects of the technology program that aligned with this
school culture were the most beneficial. This included teachers’ acceptance of the integration of
technology skills with daily classroom activities, an emphasis on uses of technology that
supported a growth mindset among students, and opportunities for students with disabilities, in
particular, to take on leadership roles in the classroom. This study is exploratory in nature and
there is a great deal of room for further research in particular to develop comparisons of self-
efficacy for students with and without SLD and in one to one laptop environments and less
technologically rich school settings.
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THE IMPACT OF A ONE TO ONE LAPTOP PROGRAM

Rivka Tuval-Mashiach, & Tamar Zilber (Eds.). Sage.


Appendix I: Student Self-efficacy survey

Modified from:

Please rate your confidence in each of these activities by choosing the best answer on the following scale:
A. Not well at all B. Not too good C. Neither good nor bad D. Very well E. Excellent

How well can you:
1. learn math?
2. learn English?
3. learn science?
4. learn social studies?
5. learn a foreign language?
6. finish homework assignments by deadlines?
7. study when there are other interesting things to do?
8. concentrate on school subjects?
9. take class notes during class?
10. organize your school work?
11. remember information presented in class and textbooks?
12. motivate yourself to do school work?
13. participate in class discussions?
14. resist peer pressure to do things in school that can get you into trouble?
15. resist peer pressure to break rules that could get you in trouble?
16. stand firm to someone who is asking to do something unreasonable or inconvenient?
17. live up to what your parents expect of you?
18. live up to what your teachers expect of you?
19. live up to what you expect of yourself?
20. make and keep friends?
21. carry on conversations with others?
22. work in a group?
23. express your opinions when other classmates disagree with you?
24. stand up for yourself when you feel you are being treated unfairly?
25. deal with situations where others are annoying you or hurting your feelings?
Appendix II: Initial Student Interview Protocol

The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

You have been selected to speak with me today because you have been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate you or your experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our assent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

*****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. Were you already provided a Chromebook by the school this year? When were you given the Chromebook?
   a. Were you provided any guidance prior to receiving it?
   b. Had you ever used a Chromebook before
2. Have you been regularly using the Chromebook so far this year?
   a. What are some examples of ways you have used the Chromebook so far?
   b. Can you show me some of the things you have been doing?
   c. How was school different before the one to one program started?
   d. Are there certain classes where you have been using the Chromebook more than others?
   e. Why do you think some teachers are using them less?
   f. Do you wish you used the Chromebook more in any of your classes? How about less?

3. In general, have you found it easier or harder to complete your work with the Chromebook?
   a. Are there some classes where the Chromebook is more helpful than others?
   b. Do you use the Chromebook to keep track of your work? To take notes?
   c. Does using the Chromebook help you to remember important information or understand things?
   d. Do you have class discussions on the computer? How do online discussions compare to traditional ones?
   e. How was school computer use different before the one to one program?
   f. What are some things that your teachers ask you to do at home with the Chromebook?
   g. How is different doing these activities on the Chromebook compared to before?

4. Are there any bad things about the one to one program?
   a. Do you have trouble remembering to charge the Chromebook?
   b. Are you ever worried about it being stolen or damaged?

5. Do you think having the Chromebook has made you more or less confident in your ability to do well in school?
   a. Are there some classes where it is more helpful than others?
b. What are some ways the Chromebook helps you to do better in school?

c. Does having the Chromebook ever stress you out?

d. Are there any ways that your teachers help to lessen this stress?

6. What is your favorite thing about having the Chromebook? Your least favorite thing?

   a. If you could change one thing about the Chromebook what would it be?

   b. Is there any ways that you think you could have been more prepared for the one to one?

   c. Are there any things you wish you knew how to do with the Chromebook?

Thank you for your participation in this interview.
Follow Up Student Interview Protocol
The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

We are following up on our previous interview from a few months ago.

As you might remember, you have been selected to speak with me today because you have been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate you or your experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our assent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

*****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. Please describe some ways that you have used the Chromebook provided by the school.
   a. What are some examples of ways you have used the Chromebook so far this year?
   b. Can you show me some of the things you have been doing?
c. How was school different before the one to one program started?

d. Are there certain classes where you have been using the Chromebook more than others?

e. Why do you think some teachers are using them less?

f. Do you wish you used the Chromebook more in any of your classes? How about less?

2. In general, have you found it easier or harder to complete your work with the Chromebook?

   a. Are there some classes where the Chromebook is more helpful than others?

   b. Do you use the Chromebook to keep track of your work? To take notes?

   c. Does using the Chromebook help you to remember important information or understand things?

   d. Do you have class discussions on the computer? How do online discussions compare to traditional ones?

   e. What are some things that your teachers ask you to do at home with the Chromebook?

   f. How is different doing these activities on the Chromebook compared to before?

3. How has your use of the Chromebook changed since the beginning of the school year?

   a. Are you using it more or less for certain tasks? How so?

   b. Are certain teachers using them in different ways? Is this helping you?

4. Are there any bad things about the one to one program?

   a. Do you have trouble remembering to charge the Chromebook?

   b. Are you ever worried about it being stolen or damaged?

5. Do you think having the Chromebook has made you more or less confident in your ability to do well in school?

   a. What are some ways the Chromebook helps you to do better in school?

   b. How do online discussions compare to traditional ones?
c. Does having the Chromebook ever stress you out?

d. Are there any ways that your teachers help to lessen this stress?

6. What is your favorite thing about having the Chromebook? Your least favorite thing?

a. If you could change one thing about the Chromebook what would it be?

b. Is there any ways that you think you could have been more prepared for the one to one?

c. Are there any things you wish you knew how to do with the Chromebook?

Thank you for your participation in this interview.
Appendix IV: Initial Parent Interview Protocol

Initial Parent Interview Protocol
The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

You have been selected to speak with me today because your child has been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate your child or his or her experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our consent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

*****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. Was your child already provided a Chromebook by the school this year? When was he/she given the Chromebook?
   a. Were you or your child provided any guidance prior to receiving it?
   b. Had you ever used a Chromebook before?
2. Do you know if your child has been regularly using the Chromebook so far this year?
   a. What are some examples of ways you have seen him/her using the Chromebook so far?
   b. Have you noticed any difference in the way your child has been completing work at home with the Chromebook compared to the past?

3. In general, do you think he/she has found it easier or harder to complete homework with the Chromebook?
   a. Do you often help your child with his/her homework?
   b. Has this changed as a result of access to the Chromebook?
   c. Has your child’s attitude about homework been impacted by the Chromebook use?

4. Has your child’s learning disabilities been a significant challenge to his/her learning? Has this changed over time?
   a. Has access to the Chromebook impacted this challenge?
   b. Are you hopeful it might have a positive impact over time?

5. Has the Chromebook program presented any challenges?
   a. Does your child have trouble remembering to charge the Chromebook?
   b. Are you ever worried about it being stolen or damaged?

6. Do you think having the Chromebook has made your child more or less confident in his/her ability to do well in school?
   a. Can you explain why?
   b. Does having the Chromebook ever stress you or your child out?
   c. Has the school done anything to alleviate this stress?

Thank you for your participation in this interview.
Follow-up Parent Interview Protocol

The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

You have been selected to speak with me today because your child has been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate your child or his or her experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our consent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. How has the use of the Chromebook been going so far this year?
   a. Has the school provided adequate support for its use?
   b. Is there anything you wish the school had done to support you and your child with its use?

2. Do you know if your child has been regularly using the Chromebook this year?
   a. What are some examples of ways you have seen him/her using the Chromebook?
b. Have you noticed any difference in the way your child has been completing work at home with the Chromebook compared to the past?

3. In general, do you think he/she has found it easier or harder to complete homework with the Chromebook?
   a. Do you often help your child with his/her homework?
   b. Has this changed as a result of access to the Chromebook?
   c. Has your child’s attitude about homework been impacted by the Chromebook use?

4. Has your child’s learning disabilities been a significant challenge to his/her learning? Has this changed over time?
   a. Has access to the Chromebook impacted this challenge?
   b. Are you hopeful it might have a positive impact over time?

5. Has the Chromebook program presented any challenges?
   a. Does your child have trouble remembering to charge the Chromebook?
   b. Are you ever worried about it being stolen or damaged?

6. Do you think having the Chromebook has made your child more or less confident in his/her ability to do well in school?
   a. Can you explain why?
   b. Does having the Chromebook ever stress you or your child out?
   c. Has the school done anything to alleviate this stress?

Thank you for your participation in this interview.
Initial Teacher Interview Protocol

The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

You have been selected to speak with me today because one or more of your students has been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate your student or his or her experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our consent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

*****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. How do you feel the one to one Chromebook program has been going so far this year?
   a. Has the school provided adequate support for its use?
   b. Is there anything you wish the school had done to support you with its use?

2. Have your students been regularly using the Chromebook as part of your class this year?
a. What are some examples of ways your students have used the Chromebook?

b. Have students been using it more at home or here at school?

3. Now, I would like to ask you a few questions about **. In general, do you think he/she has found it easier or harder to complete work with the Chromebook vs. paper or pencil?
   a. Do you often have to help this student with the Chromebook?
   b. Do you think this student’s attitude about schoolwork been impacted by the Chromebook use?

4. Are this student’s learning disabilities a significant challenge to his/her learning in your class? Has this changed over time?
   a. Has access to the Chromebook impacted this challenge?
   b. Are you hopeful it might have a positive impact over time?

5. Has the Chromebook program presented any challenges in general?
   a. Do your students have trouble remembering to charge the Chromebook?
   b. Are your students ever worried about it being stolen or damaged?

6. Do you think having the Chromebook has made this student more or less confident in his/her ability to do well in school?
   a. Can you explain why?
   b. Does having the Chromebook ever stress your students out?
   c. Has the school done anything to alleviate this stress?

Thank you for your participation in this interview.
Follow-up Teacher Interview Protocol

The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

You have been selected to speak with me today because one or more of your students has been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate your student or his or her experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our consent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

*****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. How do you feel the one to one Chromebook program has gone this year?
   a. Has the school provided adequate support for its use?
   b. Is there anything you wish the school had done to support you with its use?
   c. Has anything changed from the beginning of the school year to now?

2. Have your students been regularly using the Chromebook as part of your class this year?
a. What are some examples of ways your students have used the Chromebook?

b. Have students been using it more at home or here at school?

3. Now, I would like to ask you a few questions about **. In general, do you think he/she has found it easier or harder to complete work with the Chromebook vs. paper or pencil?

   a. Do you often have to help this student with the Chromebook?

   b. Do you think this student’s attitude about schoolwork been impacted by the Chromebook use?

4. Are this student’s learning disabilities a significant challenge to his/her learning in your class? Has this changed over time?

   a. Has access to the Chromebook impacted this challenge?

   b. Are you hopeful it might have a positive impact over time?

5. Has the Chromebook program presented any challenges in general?

   a. Do your students have trouble remembering to charge the Chromebook?

   b. Are your students ever worried about it being stolen or damaged?

6. Do you think having the Chromebook has made this student more or less confident in his/her ability to do well in school?

   a. Can you explain why?

   b. Does having the Chromebook ever stress your students out?

   c. Has the school done anything to alleviate this stress?

Thank you for your participation in this interview.
Classroom Observation Protocol
The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Flexible observation that addresses the following design questions from Marzano Research Laboratory:

Lesson Segments That Involve Routine Events That Might be Observed in Every Lesson:
What is the teacher doing to help establish and communicate learning goals, track student progress, and celebrate success?
What is the teacher doing to establish or maintain classroom rules and procedures?

Lesson Segments That Address Content:
What is the teacher doing to help students effectively interact with new knowledge?
What is the teacher doing to help students practice and deepen their understanding of new knowledge? What is the teacher doing to help students generate and test hypotheses about new knowledge?

Lesson Segments That Are Enacted on the Spot:
What is the teacher doing to engage students?
What is the teacher doing to recognize and acknowledge adherence and lack of adherence to classroom rules and procedures?
What is the teacher doing to establish and maintain effective relationships with students?
What is the teacher doing to communicate high expectations for all students?

***
Chromebook use:
How is the one to one laptop supporting classroom instruction?
Is there evidence that students are using the Chromebook to support collaboration, communication, and critical thinking?
How was use of the Chromebook introduced?
Are all students using the device in the same manner?
Are any students expressing frustration with the technology?
Appendix IX: Administrator Interview Protocol

The Impact of a One to One Laptop Program on the Self-Efficacy of Middle School Students with Specific Learning Disabilities

Interview Protocol

You have been selected to speak with me today because one or more Adams students has been identified as someone with unique experiences with technology and learning at this school. Our research project is looking at the impact of technology on the learning of students with different strengths, including those with specific learning disabilities. The project is not designed to evaluate the student or his or her experiences. Instead, we want to see if technology is being used in schools in ways that can help all students.

As described in our consent form, we would like to audio tape our conversation today to help us with our note-taking and so I can focus on you rather than on writing. The audio tape will only be used for the researchers in this study and will be destroyed at the conclusion of the study once they have been transcribed.

*****

We have planned this interview to last no longer than one hour. During this time, we have several questions we would like to ask, but feel free to add additional information that you feel is relevant. At the end of the interview, we will take any questions as well as any additional comments that you would like to make.

Are you ready to begin?

1. How do you feel the one to one Chromebook program has gone this year?
   a. Do you think the school provided adequate support for its use?
   b. Is there anything you wish the school had done differently to support its use?
2. How did the one to one program come to be introduced at Adams?
   a. Was there a common vision around the benefits of one to one?
   b. How was this vision developed?
   c. Do you feel this common vision was conveyed to staff members?
   d. How did teachers respond to this vision?

3. Was the impact on students with disabilities a consideration in the move to one to one?
   a. Do you think the program will help students with disabilities? Students with
      learning disabilities specifically?
   b. What has been done to support the success of these students in the program?
   c. Are there adequate resources to support students needs in relation to technology?

4. Is there evidence of its success to date?

5. Is there a platform for evaluating the success of the program?
   a. What is important to you in terms of an impact from the one to one program?
   b. What would you do differently if you were planning a one to one program in the
      future?

Thank you for your participation in this interview.