2013

The effects of one-to-one computing for students with disabilities in an inclusive language arts class

Billie Jo Cowley

University of Northern Iowa

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THE EFFECTS OF ONE-TO-ONE COMPUTING FOR STUDENTS WITH DISABILITIES IN AN INCLUSIVE LANGUAGE ARTS CLASS

An Abstract of a Dissertation

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

Approved:

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Dr. Susan Etscheidt, Committee Chair

______________________________
Dr. Michael J. Licari
Dean of the Graduate College

Billie Jo Cowley
University of Northern Iowa

May 2013
ABSTRACT

Technology has become increasingly prominent in schools. The purpose of this study was to examine the integration of technology with students with disabilities, particularly the use of one-to-one computing when used in inclusive classrooms. This study took a qualitative approach exploring how one teacher integrated one-to-one computing into her curriculum and how students with disabilities perceived that integration.

The nine week study took place in a rural, Midwest, eighth grade inclusive language arts classroom. The general education language arts teacher and two students who received special education services were participants in the study. Data were collected from teacher interviews, student interviews, transcripts of classroom activities, observational field notes, and document analysis.

The data analysis resulted in 11 themes in response to the three research questions. The results suggested that this teacher used a variety of resources while integrating one-to-one laptops to engage her students. The students specifically described the teacher as a role model on how to use new technological applications for academic purposes such as completing and submitting assignments electronically. The findings from teacher and student data revealed perceived learning benefits and barriers of using one-to-one computing. One significant benefit of one-to-one computing was how it assisted the teacher's integration of 21st century skills in the curriculum. This integration of one-to-one laptops leveled the playing field for students with disabilities by increasing access, promoting social benefits, and practicing the content at their level.
Students in this study experienced learning benefits as their student responsibilities changed. Despite some barriers to one-to-one implementation, students’ preference would be to continue to learn with one-to-one laptops rather than going back to traditional methods of receiving instruction.

Several recommendations to increase the integration of technology were suggested. Recommendations included structured professional development such as technology training, differentiated instruction, and constructivist teaching, additional time for peer collaboration, becoming familiar with students’ IEPs, and sharing district goals for one-to-one computing. Suggestions for future research consisted of comparing first to third year one-to-one implementation for students with disabilities, differences in technology integration between novice and experienced teachers, and the effects of gaming for students with disabilities.
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Billie Jo Cowley

University of Northern Iowa

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PERSONAL STATEMENT

As a former middle school special education teacher, I struggled with how to engage students with special needs in an inclusive setting. In social studies, science, math, and English, the material was too difficult to read, teachers were not differentiating instruction to meet the unique learning styles of all learners, and students with special needs were losing hope quickly. Often students with learning disabilities got frustrated and gave up when learning specific content. Many students receiving special education services got labeled as reluctant learners who lacked the motivation to learn in all content areas.

The problem is when students with special needs are in an inclusive classroom setting, they may not be engaged in the learning process when they need to be. When these students are in class, they often do not participate in group work nor respond to teacher questions or prompts. When asked a question, their response may be, “I don’t know.” They rarely have their homework completed. When given time to work in class, they choose to draw or engage in other nonrelated activities. From this description, students with special needs may be considered passive learners who do not take responsibility for their learning.
DEDICATION

I dedicate my dissertation to my wonderful husband, Matthew, who supported me throughout this journey. He took care of our three wonderful children, Justine, Jayla, and Maxwell so I could have time to write.

I dedicate my dissertation to the chair of my committee, Dr. Susan Etscheidt, for her constant support and feedback. Without her guidance and expertise, I would not have been able to accomplish this goal. Piece by piece and chapter by chapter, she guided me through this tedious process of fulfilling the requirements to earn my Doctorate in Special Education. I will be forever grateful for the immense amount of time Dr. Etscheidt devoted to help me and her encouraging words of wisdom. I also want to thank my other committee members for their guidance and support: Dr. Terri Lasswell, Dr. Helen Harton, Dr. William Callahan, and Dr. Leigh Zeitz.

I dedicate my dissertation to all my family, especially my mom and dad who have supported me throughout my entire life. I also want to dedicate my dissertation to my friends for their constant support and encouraging words. I especially want to thank Jessica White and Dr. Gail Moorman-Behrens for the time they spent proofreading and editing my dissertation.

I also dedicate my dissertation to my good friend, Tim Frey, for providing me a quiet place in his home to write. The peace and quiet of his home allowed me to concentrate and meet my writing deadlines.
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CHAPTER 1
INTRODUCTION

Wagner (2008) stated, "The purpose of school is to produce students who will be capable citizens and participants in our democracy – students who know how to solve problems and add value, both in their communities and in the workplace" (p.47). New technologies are being created every day that influence how we live, learn, and work. Some people embrace these technologies, whereas others may not. While every generation has its concerns about the next generation, understanding how digital technology affects young people is vital to allowing professionals working with the current generation of young people to have meaningful, supporting roles in young people’s lives (Selwyn, 2009). Bruner (1960) was forward thinking when he wrote, "One thing seems clear: if all students are helped to the full utilization of their intellectual powers, we will have a better chance of surviving as a democracy in an age of enormous technological and social complexity" (p. 10).

Student achievement has been a controversial topic in education since *A Nation at Risk* was published in 1983. The Commission listed several educational dimensions of the risk including lower student achievement in America compared to other countries, American adults who are functionally illiterate on simple tests of reading, writing, and comprehension, and lower tested achievement of students graduating from college, to name a few (U.S. Department of Education, 1983). The report claimed that U.S. schools were not preparing students for college or work. Students were graduating from high school without achieving high academic standards that could prepare them for adulthood.
From *A Nation at Risk* came a proposed educational reform to increase our nation's "commerce, industry, science, and technological innovation" (p. 1) to decrease the achievement gap between students in the United States and other countries. The achievement gap involves discrepancies between students nationally and internationally. Wagner (2008) defines the first gap in the education system as "the gap between the quality of schooling that most middle-class kids get in America and the quality of schooling available for most poor and minority children" and the *global* achievement gap as "the gap between what even our *best* suburban, urban, and rural public schools are teaching and testing versus what *all* students will need to succeed as learners, workers, and citizens in today's global knowledge economy" (p. 8). In addition to economically disadvantaged and minority groups, a pronounced achievement gap exists for students with disabilities and English language learners (Kober, 2001; West & Whitby, 2008; Williams, 2003). Laws have been established to tackle this concern.

Two major pieces of legislation attempted to address the achievement gap for children with disabilities. When passed in 2001 in response to concerns about student achievement, No Child Left Behind (NCLB) set ambitious goals that addressed increased academic achievement for all students. The purpose of No Child Left Behind was "to close the achievement gap with accountability, flexibility, and choice, so that no child is left behind" [P.L. 107-110, p. 1] and to also ensure that all students are proficient in reading, math, and science [P.L. 107-110, §1111(3)(C)(v)(I)(II)]. Each state was to establish measureable goals, and each school was to report the students' annual yearly progress in meeting the state's goals. By reporting these data, teachers were held
accountable to deliver and assess high quality curriculum that aligned with the state’s goals. The Individuals with Disabilities Education Act (IDEA) was passed in 1975 to address concerns that students with disabilities were being excluded from equal educational opportunities. The purpose of IDEA was “to provide students with disabilities an appropriate education that prepares them for further education, employment, and independent living” [20 U.S.C. §1414(d)(1)(a)]. IDEA 2004 stated that schools need to provide

(1) data that demonstrate that prior to, or as a part of, the referral process, the child was provided appropriate instruction in regular education settings, delivered by qualified personnel; and (2) Data-based documentation of repeated assessments of achievement at reasonable intervals, reflecting formal assessment of student progress during instruction, which was provided to the child’s parents [Federal Register, 2006, p. 249 §300.309(b)(1)(2)].

If a child was not meeting the state’s proficiency standards, the school needed to provide data proving that evidence-based strategies were implemented and the student did not respond to those strategies.

One of the goals of both laws, NCLB and IDEA, was to increase student achievement for students with disabilities by providing data showing that students actually learned (Moore, 2010). Both pieces of legislation required that technology was integrated effectively into curricula and instruction. IDEA stated, “The education for children with disabilities can be made more effective by supporting the development and use of technology, including assistive technology devices and assistive technology services to the maximum accessibility for children with disabilities” [20 U.S.C. §1414 (c)(5)(H)]. NCLB stated that teachers need to “identify and promote curricula and teaching strategies that integrate technology effectively into curricula and instruction”
The integration of technology must align with "challenging State academic content and student academic achievement standards" [P.L. 107-110 §2414 (b)(4)(A)] and the IEP team should "consider whether the child needs assistive technology devices and services" [Federal Register, 2006, p. 252 §300.324(a)(2)(v)]. Both pieces of legislation advocated for increased technology integration to increase student proficiency and decrease the achievement gap.

The legal requirements to increase instructional technology integration have numerous potential benefits for students with and without disabilities. These benefits include enhancing students' 21st century skills such as critical thinking and problem solving, collaboration, adaptability, entrepreneurialism, oral and written communication, accessing and analyzing information, curiosity and imagination, and motivation. Much research emphasized the importance for students to learn critical thinking and problem solving skills (Azzam, 2009; Hopson, Simms, & Knezek, 2001 - 2002; Okojie, 2011; Wagner, 2008). Students today use many forms of media to socialize with one another, which increases their abilities to collaborate effectively (Jukes, McCain, & Crockett, 2010 - 2011; Lazonder, 2005; Okojie, 2011; Selwyn, 2009). Living in a digital world has helped students become adaptable and agile in their daily lives; they can juggle many tasks at one time (Wagner, 2008). Technology has assisted students to take more initiative and become entrepreneurial by seeking out new opportunities, ideas, and strategies for improvement (Wagner, 2008). Technology has given students access to almost unlimited information and empowered them to frequently communicate orally and in writing to people from all over the world (Christensen & Horn, 2008; Selwyn, 2009;
Wagner, 2008). Immediate access through technology has nurtured students' imagination, curiosity, and motivation (Azzam, 2009; Billig, Jesse, Sherry, & Watson-Acosta, 2001; Wagner, 2008).

All these perceived benefits may have a potential impact on decreasing the achievement gap for all students but are especially promising for students with disabilities. The increased access to instructional technology may have a positive effect on students with disabilities acquiring 21st century skills that will assist them in becoming contributing members of society in inclusive settings. Oral language, vocabulary acquisition, reading comprehension, and written communication skills of students with disabilities may be enhanced through the integration of technology (King-Sears, Swanson, & Mainzer, 2011). King-Sears et al., (2011) differentiated between assistive technology and instructional technology. The authors stated, "If the student needs the technology to function, it is assistive technology, and if the student benefits from using the technology but can function without it, then it is classroom technology" (p. 569 - 570). Much research emphasized that technology integration allowed for increased access to the general education curriculum for students with disabilities and supported literacy instruction (Kennedy & Deshler, 2010; King-Sears et al., 2011; Rhodes & Milby, 2007). Benefits of assistive technology promote more inclusive placements for students with disabilities.

Even though schools have mandates to integrate technology tools into their instructional goals, a variety of barriers limit the use of technology in schools. Barriers include resources such as cost, access, and time, institutional leadership, subject culture,
teachers' attitudes and beliefs, lack of technological knowledge and skills, increased emphasis on standards tests, and the digital divide (Collins & Halverson, 2009; Hew & Brush, 2007; Johnston & Cooley, 2001). Developing a shared vision supported by a technology integration plan is one strategy schools can implement to overcome these barriers. This plan can be implemented through alternative forms of funding, increased access to technology, and rescheduling teachers' day to support professional development. Such support could help change teachers' attitudes and beliefs about integrating technology into their instruction. Success in such a venture could be determined through alternative forms of assessment (Hew & Brush, 2007; Johnston & Cooley, 2001). These strategies could become the bridge that schools need to advance the integration of technological tools to meet their instructional goals.

An array of instructional technologies is available to school districts to improve student learning. Computers are sometimes the first tool that comes to mind when thinking of instructional technologies; however, cameras, CD players, PDAs, GPS devices, computer-based probes, calculators, Web 2.0 tools such as Prezi, Glogster, Slide Rocket, and online applications such as Edmodo, wikis, and blogs are other examples of technologies that could be used in an instructional setting. Technology tools can be used to search for, locate, and present information in the classroom. For students with disabilities, these technologies may also facilitate learning and increase student access to the general curriculum. Gaming and one-to-one technology have become two recent technologies integrated into the curriculum. Gaming and one-to-one computing have the
potential to reduce the achievement gap and promote inclusive placements for students with disabilities.

Statement of the Problem and Research Claim

Both NCLB and IDEA require the integration of technology into the curriculum. This integration is mandated to decrease the achievement gap between students with disabilities and their nondisabled peers and increase inclusive placements. Technology integration can support students’ acquisition of 21st century competencies (Lowther, Ross, & Morrison, 2003), improve the quantity and quality of students' writing (Lowther et al., 2003; Russell, Bebell, & Higgins, 2004), and increase academic performance in language arts and science as measured by standardized tests (Dunleavy, Dexter, & Heinecke, 2007; Gulek & Demirtas, 2005). These benefits may be especially important for students with disabilities whose achievement gap is more pronounced. One specific benefit for students with disabilities may be the increased accessibility to the general education curriculum by leveling the playing field through technology integration. Such integration may facilitate greater academic achievement for students with disabilities and reduce the achievement gap.

Yet, even with these known benefits, the integration of technology into the core curriculum for students with disabilities may be insufficient and inadequate. Teachers may not adequately explore possible instructional technology applications for students with and without disabilities. Traditional methodologies of lecturing, PowerPoint presentations, instructional videos, and individual seatwork may not be engaging to all students today. Teachers may be underutilizing a variety of instructional technology
capable of increasing students' achievement and engagement in learning. Reasons for this underutilization include limited resources (Hew & Brush, 2007), institutional constraints (Johnston & Cooley, 2001), subject and school culture (Firestone, 2009), teachers' attitudes and beliefs (Ertmer, 1999), teachers' lack of knowledge and skills (Hew & Brush, 2007), and teachers' unfamiliarity with the digital culture (Considine, Horton, & Moorman, 2009).

Students may not be experiencing the benefits technology could afford in enhancing their content knowledge and 21st century skills. In an inclusive classroom, student engagement is believed to be critical in the learning process. Students who are not engaged may fall further and further behind academically. Students' lack of understanding of important concepts and skills may cause them to be unprepared for life after high school. Employers are likely to seek individuals who are self-motivated, work as a team, stay on task, and ask clarifying questions. The current behavior demonstrated by students with special needs in an inclusive classroom may limit their opportunities at finding appropriate jobs. Many students go home and play video games that are full of action and require the student to think critically and problem solve. Unfortunately, opportunities to use technology in school may be limited. Despite the legal mandate to improve the effectiveness of education for students with disabilities through the integration of technology, access to instructional technology may be limited for these students.

Several instructional technology applications have been researched and two that have recently generated attention are gaming and one-to-one computing. The researcher's
original intent was to examine how gaming could serve as an alternative methodology for students with disabilities. Due to the lack of gaming used in the classroom selected for the study, the researcher decided to research the application of one-to-one computing in a classroom where laptops were currently being utilized. However, the use of gaming within one-to-one applications was continually reviewed through the data analysis. One-to-one computing may be viewed as an alternative, instructional methodology to teach students with special needs in inclusive environments and to reduce the achievement gap. One-to-one computing provided students access to a mobile computing device 24 hours a day, seven days a week, which allowed students to type their papers, access information, and collaborate with other students wherever they were. Because of the intrinsic motivation some students may have to use electronics, particularly males who are overrepresented in special education programs, the opportunity for one-to-one computer access may provide learning possibilities that can help address the achievement gap for students with disabilities while being educated in the least restrictive environment. The purpose of this study was to examine the integration of technology with students with disabilities, particularly the use of one-to-one computing, when taught in inclusive classrooms. In order to explore this problem, three theoretical and conceptual frameworks were selected to guide the research.

Theoretical and Conceptual Frameworks

The theoretical and conceptual frameworks that guided this research represent a multi-dimensional lens. Motivation theories examining attribution and self-efficacy guided the exploration of student-centered attributes of instructional technology.
Constructivist theory assisted in examining the teachers' consideration, selection, and integration of instructional technology. Social constructivism, Gestalt, and conditions of learning were tenants of the constructivist framework. The learning paradigm of Bloom's Taxonomy was also explored as a conceptual framework for this study.

Motivational Theories

Motivation is the study of "why people think and behave as they do and what pushes or pulls an individual to start, direct, sustain, and finally end an activity" (Guthrie, 2003, p. 1690). Reiser and Dempsey (2007) define motivation as “a person’s desire to pursue a goal or perform a task, which is manifested by choice of goals, and effort (persistence plus vigor) in pursuing the goal” (p. 84). In the classroom context, motivation refers to students' willingness to participate in class activities (Cheng & Yeh, 2009). Lebow (1993) suggested two ways that teachers can design instruction so that student achievement and motivation may be improved: (1) instruction must relate to the interests, experiences, and personal goals of the learner to increase motivation, and (2) learning and motivation should be seen as one because they are interdependent processes.

Student motivation may be extrinsic and/or intrinsic. Extrinsic motivation occurs outside the individual and task performed. Typical examples of extrinsic environmental incentives and consequences are food and money (Cheng & Yeh, 2009). Students become motivated to perform the desired behavior based on the incentive they will obtain. Students who are extrinsically motivated may exert little effort and may stop once they have received the reinforcement. Intrinsic motivation occurs within an individual or task. Rather than receiving a tangible reward, students who are intrinsically motivated are self-
determined and self-regulate their actions to feel competent. Several advantages exist for students to be intrinsically motivated rather than extrinsically motivated. Students who are intrinsically motivated tend to select more challenging tasks, gain more knowledge from reading information they are intrinsically interested in, display greater creativity and better conceptual learning, and have greater pleasure while being more actively involved in activities (Cheng & Yeh, 2009).

Schools may be an insufficient source of intrinsic motivation and a difficult location for students to increase their self-esteem (Bruner, 1996), especially for students with special needs. Bruner (1996) stated, “School is supposed to provide a setting where our performance has fewer esteem-threatening consequences than in the ‘real world,’ presumably in the interest of encouraging the learner to ‘try things out’” (p. 37). When students’ self-esteem is diminished, it affects their motivation to learn. Motivation is influenced by attribution and self-efficacy.

**Attribution theory.** Attribution theory originated in social psychology and is especially concerned with the "situational determinants of motivation and with both self-perception and the perception of others" (Guthrie, 2003, p. 1693). Weiner's (1979) theory of achievement motivation and emotion explains the expectancy for success when an individual is attempting to accomplish a goal and is concerned with causal inferences that an event has occurred (Weiner, 1979; Weiner, 1985). Attribution theory explains how a person’s tendency to attribute successes or failures to such causes as ability, effort, mood, luck, or task difficulty will affect his/her motivation to persist in trying to accomplish easy versus challenging goals (Reiser & Dempsey, 2007; Weiner, 1979; Weiner, 1985).
Help or hindrance from others is another inferred cause of success and failure. Often, students who lack confidence have difficulties taking credit for something well done or try to find a scapegoat when tasks are unsuccessfully completed.

**Dimensions of attribution theory.** Attribution theory of achievement motivation and emotion consists of four dimensions of causality, which are locus, stability, controllability, and globality. The locus dimension differentiates whether the cause was internal or external to the person (Guthrie, 2003). Examples of internal causes are ability, effort, mood, and fatigue, whereas external causes consist of task difficulty and luck (Weiner, 1985). This dimension "determines whether pride and self-esteem are altered following success or failure" (Alkin, 1992, p. 861). Internal locus of control increases a person's self-esteem after success and decreases self-esteem after failure of a difficult task. When a person is performing an easy task, he/she has low self-esteem because of the perceived ease of the task (Weiner, 2010). The stability dimension defines causes on a stable versus unstable continuum. Weiner (1985) stated that ability is a constant (stable) internal cause, whereas effort and mood are variable (unstable) internal causes. Task difficulty would be considered a stable external cause, and luck is an unstable external cause. "If a positive outcome is ascribed to a stable cause, future success is anticipated" (Alkin, 1992, p. 861). Likewise, negative outcomes associated with stable causes lead to inferences that future success is unlikely. Because of this causal relationship between stability and expectancy, attribution retraining programs have been established that teach students to attribute failure to lack of effort rather than lack of ability (Guthrie, 2003). The third dimension of controllability is "the extent to which a cause is subject to
volitional alteration" (Guthrie, 2003, p. 1692). Weiner (1979) describes ability as a stable uncontrollable internal cause, and mood, fatigue, and illness as unstable and uncontrollable. Task difficulty is a stable and uncontrollable external cause, and luck is unstable and uncontrollable. Interpersonal affects that an individual may experience are anger, guilt, pity, sympathy, and shame (Alkin, 1992; Guthrie, 2003). Anger is often experienced when an individual is prevented from success by external factors, whereas guilt is self-directed when an individual breaks a social contract due to internal controllable causes. The last dimension of globality is not as familiar as the previous three. The global dimension describes how some causes are specific to a situation, whereas other causes can be generalized across settings (Weiner, 1979; Weiner, 1985). A specific causal example could be a student who is not good at algebra, and a general example could be that the student views him/herself as having a lower intelligence.

The three attribution dimensions of locus, stability, and controllability, all work together. The table below displays how the causes of success and failure connect according to the three dimensions.
Table 1

*Causes of Success and Failure, Classified According to Locus, Stability, and Controllability*

<table>
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<tr>
<td></td>
<td>Stable</td>
<td>Unstable</td>
</tr>
<tr>
<td>Uncontrollable</td>
<td>Ability</td>
<td>Mood</td>
</tr>
<tr>
<td>Controllable</td>
<td>Typical effort</td>
<td>Immediate effort</td>
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Table adopted from Weiner, 1979, p. 7

As one can see from the table above, internal and external loci are dependent on the stability and controllability of the cause. The locus has implications for self-esteem, which is an emotional consequence of achievement performance. The stability dimension is contingent on the magnitude of expectancy change following success or failure (Weiner, 1979). This dimension “integrates attribution theory with expectancy-value formulations of motivation” (Weiner, 1979, p. 8). The perceived control one has over the cause addresses both self- and other-perception and intra- and interpersonal behavior (Weiner, 1979). How is the self-esteem of students with disabilities affected by the locus of control? Do students with disabilities generalize stability and expectancy of success? What emotions do students with disabilities exhibit when they experience success or failure? How do these dimensions affect the achievement of students with disabilities?

Another characteristic of attribution theory is discussed by Cheng and Yeh (2009) describing Keller's (1987) adapted version of the expectancy-value theory. Expectancy-value theory is described as a person's motivation to engage in activities that he/she will
experience success and attain desired goals (Cheng & Yeh, 2009; Weiner, 2010; Weiner & Graham, 1999). Keller's version of the expectancy-value theory was identified as the ARCS model, which represents attention, relevance, confidence, and satisfaction. Instructional designers use the ARCS model to vary motivational strategies to gain and keep learners' attention (Paas, Tuovinen, van Merrienboer, & Darabi, 2005). In order for teachers to motivate students through technology integration, they must integrate these four conditions. Teachers need to stimulate and sustain students' attention in order for them to acquire information. The content and the delivery of the information also needs to be relevant to the student. If students acknowledge the relevance of the information or task, they may accept the probability for success. Students' confidence influences their persistence and achievement. The last condition students must have in order to be motivated is satisfaction. If the student is satisfied with the effort and end result, then he/she is more likely to be motivated to learn. How can teachers apply the ARCS model for students with disabilities when technology is integrated into the curriculum? Will students' attention, confidence, satisfaction, and achievement improve with one-to-one computing integration thereby decreasing the achievement gap between students with and without disabilities?

*Attributional process.* Two significant biases associated with the attribution process are hedonic bias and actor-observer perspective. Hedonic bias is a concept that means an individual takes credit for success and/or attributes failure to external factors (Weiner & Graham, 1999). Individuals tend to ascribe good events with success and bad events with failure. An example of taking credit for success is a student earning an A on a
test because he/she studied versus attributing failure to external factors such as earning a D because the teacher made the test unfair (Alkin, 1992). The second bias is the actor-observer perspective. This bias describes how actors attribute their actions to situational requirements, whereas the observer attributes the actions to stable dispositions (Weiner & Graham, 1999). In answering a question such as “Why did you do that?”, the actor may reply by saying he/she was provoked, whereas the observer may say the individual behaved that way because he/she is aggressive.

Table 2 below outlines the attributional process in relation to antecedent conditions, perceived causes, causal dimensions, psychological consequences, and behavioral consequences.
Table 2

*Attributional Process*

<table>
<thead>
<tr>
<th>Antecedent Conditions</th>
<th>Perceived Causes</th>
<th>Causal Dimensions</th>
<th>Psychological Consequences</th>
<th>Behavioral Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental factors</td>
<td>Attributions for</td>
<td>Stability</td>
<td>Expectancy for success</td>
<td>Choice</td>
</tr>
<tr>
<td>• Specific information</td>
<td>Ability</td>
<td>Control</td>
<td>Self-efficacy</td>
<td>Persistence</td>
</tr>
<tr>
<td>• Social norms</td>
<td>Effort</td>
<td></td>
<td>Affect</td>
<td>Level of effort</td>
</tr>
<tr>
<td>• Situational Features</td>
<td>Luck</td>
<td></td>
<td></td>
<td>Achievement</td>
</tr>
<tr>
<td>Personal factors</td>
<td>Task difficulty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Causal schemas</td>
<td>Teacher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Attributional bias</td>
<td>Mood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Prior knowledge</td>
<td>Health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Individual differences</td>
<td>Fatigue</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Pintrich & Schunk, 1996)

As one can see from the table above, incidents can be categorized as environmental or personal. The student will attribute the incident to a perceived cause and causal dimension. Motivation, affective, or behavior consequences are affected by the attribution. How do teachers respond to students' perceived bias in relation to good and bad events? How can students overcome the generalization that success results from internal factors and failure results from external factors? What strategies can be taught to students with disabilities so they can identify internal and external factors that contributed to an incident?
Students with disabilities may attribute much of their success or failure to perceived causes such as their ability, effort, luck, the task difficulty, teacher, mood, health, or fatigue. Failure may be a regular occurrence for students with disabilities, which affects their self-esteem. When students' self-esteem is low, they lack motivation, which can cause difficulties acquiring new knowledge and skills. Teachers' goals should be to find ways to increase students' self-esteem so they are motivated to learn.

Instructional technology is a tool that may be intrinsically motivating for students with disabilities.

**Self-efficacy theory.** Unlike attribution theorists who focus on perceived causes to explain the expectancy of success, self-efficacy theorists study prior accomplishments or experiences, social modeling, social persuasion, and emotional arousal as antecedents (Bandura, 2004). The concept of self-efficacy emerged from a social learning perspective (Bandura & Schunk, 1981) and has close ties with behavioral change (Guthrie, 2003). A sense of self-efficacy is future-oriented rather than past-oriented as it pertains to a "person's belief in his or her capability of performing a behavior required to reach a goal" (Alkin, 1992, p. 861). Bandura's social cognitive theory is based on the belief that individuals learn from observing the behaviors of others (Bussu & Bandura, 1999) through instructive, motivational, social prompting, and social construction functions (Bandura, 2004). In social learning theory "self-directedness operates through a self-system that comprises cognitive structures and subfunctions for perceiving, evaluating, motivating, and regulating behavior" (Bandura & Schunk, 1981, p. 586). Self-efficacy is the most pervasive mechanism of self-influence as it is the foundation of human
motivation and accomplishments. The factors that enhance a student's self-efficacy and improved performance result when the student

(1) adopts short-term over long-term goals, inasmuch as progress is easier to judge in the former case; (2) are taught to use specific learning strategies, such as outlining and summarizing, both of which increase attention to the task; and (3) receives performance-contingent rewards as opposed to reinforcement for just engaging in a task, because only in the former case does reward signal task mastery (Guthrie, 2003, p. 1693).

Self-efficacy can increase students' belief in themselves that they can accomplish the task presented to them, which in turn increases students' effort and achievement. When students develop short term goals, is their self-efficacy affected? How will the self-efficacy of students with disabilities be affected if teachers explicitly integrate instructional technology to teach specific learning strategies? How do rewards affect the goal attainment for students with disabilities?

Self-actualization. Another contribution of motivation theory to this research is self-actualization. Self-actualization attempts to explain how goals become important to people and influence their behavior (Reiser & Dempsey, 2007). Self-actualized individuals are described as having a more efficient perception of reality and more comfortable relations with it. These individuals are accepting of themselves, others, and nature. Self-actualized individuals are spontaneous and problem-centered rather than ego-centered. These individuals like solitude, privacy, and autonomy, and may show deep feelings of identification, sympathy, and affection. They may also be described as having profound interpersonal relations, having a sense of humor, being creative, and being resistant to enculturation (Maslow, 1954). The idea of this hierarchy is holistic in nature, which mirrors the Gestalt theory. Although Maslow's hierarchy of needs is a useful lens
to examine curricular structure in the classroom, his theory has generated considerable controversy. The criticisms of Maslow's theory include his disregard to learn cultural norms, portrayal of a humanist approach rather than a behaviorist view, contradiction of his own theory, and uncertainty of how one becomes self-actualized (Neher, 1991). Other critics state that the popularity of Maslow's hierarchy corresponds to people's common sense in how most people behave; however, several behavioral exceptions to the hierarchy exist (Peterson & Park, 2010). A revised hierarchy has been proposed that removed self-actualization as critics argue that it is "unlikely to be a functionally distinct human need" (Kenrick, Griskevicius, Neuberg, & Schaller, 2010, p. 293). The revised hierarchy provides connections to current innovations and evolutionary and positive psychology (Kenrick et al., 2010).

Despite concerns and criticisms, Maslow’s hierarchy may provide a useful lens to examine the integration of technology. When one-to-one computing is integrated into instruction, do students with disabilities demonstrate the characteristics of a self-actualized person? Are teachers meeting students' lower needs in order to motivate them to reach higher order needs? Will the integration of one-to-one laptops enable students with disabilities to be self-actualized?

**Constructivism**

Constructivist theory provided a useful lens in examining the teacher's integration of instructional technology. Learning is an active process in which the learner constructs new ideas based upon their current or past knowledge. A way of thinking about knowing is sometimes referred to as metacognition (Bruner, 1996). Constructivist theory was also
a theory of communication that suggested learners use and process communication differently (Brooks & Brooks, 1993). In this section, the pedagogical foundation of this research centered on the constructivist theory and other interrelated theories such as Gestalt, social constructivism, Bloom’s Taxonomy, and conditions of learning.

In *The Process of Education*, Bruner (1960) stated, “Educational psychologists turned their attention with great effect to the study of aptitude and achievement and to the social and motivational aspect of education, but did not concern themselves directly with the intellectual structure of class activities” (p. 4). Bruner (1960) developed four main themes in his earlier work. He stressed the importance of structure, readiness for learning, intuitive and analytic thinking, and motives for learning. The importance of structure emphasizes how teachers need to revamp their teaching materials to align with the capabilities of their students as well as encourage discovery. The second theme that emerged was students’ readiness for learning. Bruner’s view on this emerged from Piaget’s theory of cognitive development, which consists of sensory motor, preoperational, concrete operations, and formal operations. Teachers need to teach students according to their cognitive readiness. Concepts then need to follow three acts of learning, which Bruner (1960) defined as acquisition, transformation, and evaluation. Bruner also suggested that intuitive and analytical thinking should be encouraged by students. “The intuitive thinker may even invent or discover problems that the analyst would not. But it may be the analyst who gives these problems the proper formalism” (Bruner, 1960, p. 58). The last theme that emerged from Bruner’s earlier work was that
he investigated motivation for learning. Students' interests should be incorporated into teacher planning to encourage active learning.

Modern pedagogy has an increased emphasis on the learner becoming aware of his/her own thought process and actively and personally constructing meaning from knowledge (Schacter & Fagnano, 1999). Learners should know how they think and learn about content knowledge as well as reflect upon their thinking (Bruner, 1996). One way to facilitate this learning is through problem solving. When learners recognize the relevance of a problem, they are more apt to think critically to find solutions and reflect upon the big concepts (Brooks & Brooks, 1993). Learning occurs when students' expectations are not met and they must "resolve the discrepancy between what was expected and what was actually encountered" (Schacter & Fagnano, 1999, p. 335). Learning by design and project-based learning involves processes requiring students to solve problems or answer questions. This type of learning fosters critical thinking, judgment, and personal involvement, all 21st century skills students must know.

Technology can be the tool in which learning by design and project-based learning processes are designed. Technology, specifically computers, can assist in collecting, analyzing, reporting, and publishing results of projects, which is one example of how "technology can increase student learning and motivation to learn" (Schacter & Fagnano, 1999, p. 337). In what ways can teachers design instruction with technology so the acquisition of 21st century skills can be obtained? What are the teachers' and students' roles in a constructivist classroom? How can technology be integrated into the curriculum so that students with disabilities construct their own knowledge?
Principles of constructivist learning. Key principles are associated with constructivist learning theory. One principle requires the learner to use sensory input to make meaning of it. Learning consists of constructing meaning and systems of meaning in the mind with the use of language. This learning takes time and is typically a contextual, social activity based on knowledge (Vygotsky, 1978). Learners go over information, ponder it, use it, practice, and experiment. Motivation is a critical component of learning as it causes the learner's sensory apparatus to be activated. Relevance, curiosity, fun, accomplishment, achievement, external rewards, and other motivators facilitate ease of learning (Bruner, 1960). These principles reflect contributions made by constructivists.

Characteristics of a constructivist teacher. Brooks and Brooks (1993) compiled a list of characteristics constructivist teachers should display. Teachers should encourage and accept student autonomy and initiative. Data and primary sources, along with manipulative, interactive, and physical materials should be used by constructivist teachers. When framing tasks, constructivist teachers use cognitive terminology such as “classify,” “analyze,” “predict,” and “create.” Lessons are student-centered and are driven by student responses that shift instructional strategies and alter content. Teachers check students' understandings of concepts by seeking elaboration of students' initial responses before sharing their own understandings of those concepts. This could include encouraging dialogue with both the teacher and other students. Constructivist teachers also engage student inquiry through experiences that might contradict students' initial hypotheses, which causes students to ask thoughtful, open-ended questions of each other.
Constructivist teachers allow wait time after posing questions and provide time for students to construct relationships and create metaphors. Finally, constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model (Brooks & Brooks, 1993). These characteristics reflect the importance of social learning and students' abilities to problem solve in order to make meaning, which Bruner’s earlier work and the influences of Wertheimer (1924; as cited in Westheimer, 1999), Vygotsky (1978), Gagne (1985), and Bloom (1956) illustrate. When teachers exhibit these characteristics in the classroom, it allows their students to adapt to the world they live in and become contributing members of society. Students begin to make meaning of the world around them and construct ways to assist in the process of change (Bruner, 1996).

How can teachers change the paradigm in teaching, learning, and assessment in technology-rich environments? Will this paradigm shift decrease the achievement gap for students with disabilities?

An additional contribution of constructivism is a two-dimensional model of information and communication technologies (ICTs) for integrating technology into education. The vertical axis of the model displays a range of technical competency of the teacher. These competencies ranged from 0 to 7 with 0 being defined as nonuse and 7 defined as implementing sophisticated instructional systems. The horizontal axis describes the pedagogical competency used with technology. The four levels of pedagogy range from direct teaching, cognitively active learning, constructive learning, and social learning (Lin, Wang, & Lin, 2012). A teacher who uses the constructivist learning pedagogy was described as a teacher who "believes that learners construct their own
knowledge on the basis of interaction with their environment. He or she establishes a learning environment to support and challenge students' thinking and becomes a facilitator for students' sense-making of new knowledge items" (Lin et al., 2012, p. 102). Teachers' primary role is to offer students suggestions for improvement and guide them to success. Students' roles are to "make meaningful interpretations of new knowledge items and create linkage between new knowledge items and the real-life world" (Lin et al., 2012, p. 102). Problem-based exploration and inquiry-based projects are typically assigned in a constructivist classroom. Will problem-based exploration and inquiry-based projects utilizing technology motivate students with disabilities to learn essential concepts and skills? What benefits will teachers and students gain from technology integration?

Gestalt Theory

The Gestalt theory emphasized a holistic approach examining the whole system and not just the parts. Learners cannot just respond to one stimulus; they need to understand how all the parts work together as a whole system (Westheimer, 1999). Bruner (1985) stated, "By structural rules it is intended to emphasize that knowledge is not local but derived from a structure of the whole - that local operations reflect universal operations of the system as a whole" (p. 6). Gestalt theory is embedded in the constructivist theory. Bruner referenced the Gestalt theory when describing how learners need to construct and make meaning of the world by seeing the whole picture and then breaking it up into the parts for further understanding. Do teachers provide opportunities for students with disabilities to learn new information holistically? How does one-to-one
computing assist teachers in helping students understand how all the parts fit into the whole system?

**Social Constructivism**

Vygotsky coined the term zone of proximal development, which he defined as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Vygotsky is known for social constructivism, which focuses on the social aspect of learning with the teacher having an active role. "The acquisition of language can provide a paradigm for the entire problem of the relation between learning and development. Language arises initially as a means of communication between the child and the people in his environment" (Vygotsky, 1978, p. 89). Jerome Bruner was influenced by Lev Vygotsky and adopted a social view of learning. Bruner stressed the importance of the social setting when the learner was acquiring language.

Social constructivism supports the effectiveness of collaboration or social learning. The teacher needs to provide learning situations so the learner can move from dependent to independent problem solving. The teacher provides experiences to assist the learner in the “functions that have not yet matured but are in the process of maturation” (Vygotsky, 1978, p. 86). The assistance of teachers can increase the mental development of learners as opposed to what they can do alone. Vygotsky (1978) stated, "Human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them" (p. 88). Cooperative learning boosts student
achievement as students have an opportunity to discuss their ideas, opinions, and beliefs with others (Schacter & Fagnano, 1999). During these discussions, conflicts may occur in which students have to explain their beliefs. Consequently, greater understanding and achievement is gained by justifying one's thought process. Constructivist teachers could provide opportunities for students to work independently or socially when learning a concept. Students work with peers or receive scaffold guidance from the teacher in a socially constructivist classroom, whereas students may work in isolation in a constructivist classroom. Could social learning through technology decrease the achievement gap between students with and without disabilities and promote inclusive placements? How do teachers create a learning environment that intertwines social learning and instructional technology?

Conditions of Learning

Robert Gagne’s theory on conditions of learning intertwines with Bruner’s constructivist theory. Gagne expressed his belief that learning is dependent on experiences and environmental facts. He defined learning as “a change in human disposition or capability that persists over a period of time and is not simply ascribable to processes of growth” (Gagne, 1985, p. 2). Common themes that emerged throughout Gagne’s literature were the learner’s need to generalize information, the attitude of the learner, and the need to differentiate instruction by the process.

Learning outcomes. Gagne (1984) defined and described five categories of learning outcomes. These five categories were intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes. Intellectual skills included procedural
knowledge such as concepts, rules, and procedures. In order for learners to possess these skills, acquisition of learning must take place. Just as Bruner (1960) described, Gagne stated learners must follow a series of acts that consists of acquisition, proceduralization, and automatization in order for intellectual skills to actually be learned and generalized (Gagne, 1984). Verbal information was referred to as declarative knowledge. The learner is able to verbally reinstate or reconstruct information to make meaning. The third learning outcome was cognitive strategies. “A cognitive strategy enables a learner to exercise some degree of control over the processes involved in attending, perceiving, encoding, remembering, and thinking” (Gagne, 1984, p. 381). Strategies differ from learner to learner because of how learners process information. Motor skills were the fourth learning outcome. Learners are introduced to activities that require the use of their fine and gross motor skills. Learners continually practice these activities to increase the quality and efficiency of their motor skills (Gagne, 1984). The last learning outcome was attitude. “An attitude is an internal state that influences the choice of personal action” (Gagne, 1984, p. 383). Therefore, attitudes influence behavior.

Gagne stated these five learning outcomes do not represent a taxonomy but rather a learning paradigm. This paradigm addressed that (1) “human performances differ, (2) the requirements for their learning are different, and (3) the effects of learning appear to differ from each other” (Gagne, 1984, p. 384). This reiterates the fact that every individual learns differently.

Knowing these conditions makes it possible for the teacher to reach the proper decisions about what achievements the student is being motivated for and to give suitable guidance concerning the possible directions of future learning that may be available to the student (Gagne, 1970, p. 28).
Gagne's contribution to education has been a proponent for instructional technology. How has Gagne's learning theory impacted the way teachers integrate technology into their instruction? Do teachers differentiate their instruction through the use of one-to-one computing?

**Bloom's Taxonomy**

Categorizing is done to keep things organized and help identify when objects have certain characteristics (Bruner, Goodnow, & Austin, 1956). The purpose of Bloom's Taxonomy was "to provide for classification of the goals of our educational system" (Bloom, 1956, p. 1). Teachers should be able to define ambiguous terms and make decisions regarding the curriculum and evaluation devices appropriate for their students by using this taxonomy. Ultimately, this would facilitate a common language among educators. The table below is organized into the three domains the taxonomy includes: cognitive, affective, and psychomotor.
Table 3

*Bloom’s Taxonomy Domains*

<table>
<thead>
<tr>
<th>Cognitive Knowledge</th>
<th>Affective Attitude</th>
<th>Psychomotor Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall data</td>
<td>Receive (awareness)</td>
<td>Imitation (copy)</td>
</tr>
<tr>
<td>Understand</td>
<td>Respond (react)</td>
<td>Manipulation (follow instructions)</td>
</tr>
<tr>
<td>Apply (use)</td>
<td>Value (understand and act)</td>
<td>Develop precision</td>
</tr>
<tr>
<td>Analyze (structure/elements)</td>
<td>Organize personal value system</td>
<td>Articulation(combine integrate related skills)</td>
</tr>
<tr>
<td>Synthesize (create/build)</td>
<td>Internalize value system (adopt behavior)</td>
<td>Naturalization (automate, become expert)</td>
</tr>
</tbody>
</table>

Evaluate (assess, judge in relational terms)

Adapted from http://www.unleashthemonster.net/images/Resources/bloomstaxonomy_whitepaper1109.pdfaxon

The domains assist teachers in developing lessons appropriate to the developing learner. Constructivist theory has an increased emphasis on utilizing the affective domain (Lebow, 1993). The learner’s attitude can affect how much meaningful learning has taken place. Bloom went further to develop six classes of educational behaviors that were organized from simple to complex (Bloom, 1956). The six classes consisted of the following terms: knowledge, comprehension, application, analysis, synthesis, and evaluation. These terms can be connected to constructivist theory. Knowledge would relate to the acquisition of information and as the learner moved up the taxonomy to more complex classes, the learner would experience the other two acts of learning:
transformation and evaluation. The original taxonomy began at the knowledge domain, lower-level thinking skills, and gradually increased in complexity to higher order thinking skills consisting of comprehension, application, analysis, synthesis, and evaluation.

**Bloom's revised taxonomy.** Recently, Lorin Anderson, a former student of Bloom, revised Bloom's original taxonomy. The names of each class have been changed from nouns to active verbs to depict a more active form of thinking. She slightly rearranged the more complex classes (Overbaugh & Schultz, n.d.). The new domain begins with remembering and increases in complexity to understanding, applying, analyzing, evaluating, and creating. Teachers use these verbs to align educational objectives with each taxonomy. These objectives help teachers evaluate their students to determine if the objective was met.

**Summary of Theoretical and Conceptual Frameworks**

The theoretical and conceptual frameworks that guided this research were through a motivation, constructivist, and learning paradigm lens. Motivation theories were examined to explore how students perceived the integration of one-to-one computing. The constructivist theory was examined to explore how teachers considered, selected, and used one-to-one computing into their instruction. The learning paradigm of Bloom's Taxonomy was also explored as a conceptual framework to explore how teachers aligned each learning domain with the integration of technology. The integration of these three theoretical frameworks assisted the researcher in answering the research questions that guided this study.
Research Questions

1. How do teachers integrate one-to-one computing in an inclusive language arts classroom?

2. What do teachers perceive as the learning benefits and barriers of using one-to-one computing in inclusive classrooms?

3. What do students with disabilities perceive as learning benefits and barriers to one-to-one computing?

Purpose for the Study

Each state is feeling the pressure of meeting the Annual Yearly Progress (AYP) requirements of NCLB. Specific pressure is on increasing the scores of the four subgroups on which states must report: economically disadvantaged students, students from major racial and ethnic groups, students with disabilities, and students with limited English proficiency [P.L. 107 - 110, §1111(2)(C)(v)(II)(aa)(bb)(cc)(dd)]. The purpose of this study examined how one teacher integrated and used technology to meet the individual needs of students with disabilities and the requirements and provisions of NCLB and IDEA.

Both the NCLB and IDEA laws set ambitious goals addressing the achievement gap and integration of technology into instruction. In achieving these goals, teachers investigated a variety of instructional technologies that may decrease the achievement gap and promote inclusive placements for children with disabilities, particularly males who are overrepresented in special education programs. The purpose of this study was to examine how one teacher used one-to-one computing as an alternative methodology to
teach students with disabilities in an inclusive environment. The present qualitative study collected data through participant observations, teacher interviews, and student interviews. The study was conducted in a small rural middle school in the Midwest. The participant observations were conducted in an attempt to capture how the teacher integrated technology on a daily basis to meet students' needs. Teacher interviews were conducted in an attempt to understand how and why the teacher integrated one-to-one computing. Student interviews were conducted in an attempt to examine how students perceived the integration of one-to-one computing. For students with disabilities, integrating one-to-one computing into the curriculum may increase independent functioning, decrease the achievement gap, and increase access to the general education curriculum.

Significance for the Study

Many quantitative studies (Dunleavy & Heinecke, 2008; Hembrooke & Gay, 2003; Keengwe, Schnellert, & Mills, 2012; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010) and mixed-methods studies (Bebell & Kay, 2010; Corn, Tingen, Argueta, Patel, & Stanhope, 2010; Mouza, 2008; Russell et al., 2004; Warschauer, 2008) have examined one-to-one computing applications. However, these studies failed to provide an in-depth examination of teacher and student perceptions regarding the integration. Few qualitative studies exist that have explored teacher and student perceptions measured by participant observation, teacher interview, and student interview. This study carefully and fully examined how one-to-one computing was integrated into inclusive classrooms. The researcher hoped to better understand how general education teachers integrate one-to-
one computing into their instruction to meet the mandates of NCLB and IDEA. The researcher also hoped to identify how students with disabilities were impacted by the integration of one-to-one computing.

The particular focus of this research was students with disabilities. A plethora of research exists that identifies the achievement gap between students with and without disabilities (Kober, 2001; Maleyko & Gawlik, 2011; Wagner, 2008; Williams, 2003). This achievement gap is most pronounced during the middle school years. This research examined teacher and student perceptions of the integration of one-to-one computing in an inclusive language arts class at the middle school level.

One-to-one computing may give students with disabilities a sense of independence, which may increase their confidence. As this technology was explored, it may become an avenue to ensure progress towards literacy-based IEP goals for students with disabilities.

Summary

This chapter defined and described the achievement gap, requirements of NCLB and IDEA, a brief description of the benefits of instructional technology for students with disabilities, barriers to technology integration, and an array of instructional technology options. The purpose of this study was to examine the integration of one-to-one computing access with students with disabilities when taught in inclusive classrooms. The theoretical and conceptual frameworks for this study were guided by motivational theories, constructivist learning theory, and Bloom's Taxonomy. These theories provided
a lens that supported the goals of this study. Three research questions also guided this research.

Integrating technology into the curriculum has become an important tenant of NCLB and IDEA. Chapter 2 is a literature review of legislation pertaining to the histories of both laws, principles and provisions, and landmark court cases. The importance of integrating instructional technology was reviewed. Barriers to this integration were discussed as well as strategies to overcome those barriers. The chapter concludes by describing two specific types of instructional technologies, gaming and one-on-one laptops. The impact of integration of these two technologies for students with disabilities was also reviewed.
CHAPTER 2
REVIEW OF LITERATURE

Student achievement has been a controversial topic in education since *A Nation at Risk* was published in 1983. The Commission listed several educational dimensions of the risk including lower student achievement in America compared to other countries, American adults who are functionally illiterate on simple tests of reading, writing, and comprehension, and lower tested achievement of students graduating from college, to name a few (U.S. Department of Education, 1983). The report claimed that U.S. schools were not preparing students for college or work. Students were graduating from high school without achieving high academic standards that could prepare them for adulthood. From *A Nation at Risk* came a proposed educational reform to increase our nation's "commerce, industry, science, and technological innovation" (p. 1) to decrease the achievement gap between students in the United States and other countries. The achievement gap involves discrepancies between students nationally and internationally. Wagner (2008) defines the first gap in the education system as "the gap between the quality of schooling that most middle-class kids get in America and the quality of schooling available for most poor and minority children" and the global achievement gap as "the gap between what even our best suburban, urban, and rural public schools are teaching and testing versus what all students will need to succeed as learners, workers, and citizens in today's global knowledge economy" (p. 8). In addition to economically disadvantaged and minority groups, a pronounced achievement gap exists with students
with disabilities and English language learners (Kober, 2001; West & Whitby, 2008; Williams, 2003). Laws have been established to tackle this concern.

Two major pieces of legislation attempted to address the achievement gap for children with disabilities. When passed in 2001 in response to concerns about student achievement, No Child Left Behind set ambitious goals that addressed increased academic achievement for all students. The purpose of No Child Left Behind was "to close the achievement gap with accountability, flexibility, and choice, so that no child is left behind" [P.L. 107-110, p. 1] and to also ensure that all students are proficient in reading, math, and science [P.L. 107-110, §1111(3)(C)(v)(I)(II)]. Each state was to establish measurable goals, and each school was to report the students' annual yearly progress in meeting the state's goals. By reporting these data, teachers were held accountable to deliver and assess high quality curriculum that aligned with the state's goals. The Individuals with Disabilities Education Act (IDEA) was passed in 1975 to address concerns that students with disabilities were being excluded from equal educational opportunities. The purpose of IDEA was "to provide students with disabilities an appropriate education that prepares them for further education, employment, independent living" [20 U.S.C. §1414(d)(1)(a)]. IDEA 2004 stated that schools need to provide

(1) data that demonstrate that prior to, or as a part of, the referral process, the child was provided appropriate instruction in regular education settings, delivered by qualified personnel; and (2) Data-based documentation of repeated assessments of achievement at reasonable intervals, reflecting formal assessment of student progress during instruction, which was provided to the child's parents [Federal Register, 2006, p. 249 §300.309(b)(1)(2)].
If a child was not meeting the state's proficiency standards, the school needed to provide data proving that evidence-based strategies were implemented and the student did not respond to those strategies.

One of the goals of both laws, NCLB and IDEA, was to increase student achievement for students with disabilities by providing data showing that students actually learned (Moore, 2010). Both pieces of legislation required that technology be integrated effectively into curricula and instruction. IDEA stated that “the education for children with disabilities can be made more effective by supporting the development and use of technology, including assistive technology devices and assistive technology services to the maximum accessibility for children with disabilities” [20 U.S.C. §1414(c)(5)(H)]. NCLB stated that teachers need to “identify and promote curricula and teaching strategies that integrate technology effectively into curricula and instruction” [P.L. 107-110 §2414(b)(4)(A)]. The integration of technology must be aligned with “challenging State academic content and student academic achievement standards” [P.L. 107-110 §2402(a)(4)] and the Individualized Education Program (IEP) team should "consider whether the child needs assistive technology devices and services" [Federal Register, 2006, p. 252 §300.324(a)(2)(v)]. Both pieces of legislation advocated for increased technology integration to increase student proficiency and decrease the achievement gap.

The legal requirements to increase instructional technology integration have numerous potential benefits for students with and without disabilities. These benefits include enhancing students’ 21st century skills such as critical thinking and problem
solving, collaboration, adaptability, entrepreneurialism, oral and written communication, accessing and analyzing information, curiosity and imagination, and motivation. Much research emphasized the importance for students to learn critical thinking and problem solving skills (Azzam, 2009; Hopson et al., 2001 - 2002; Okojie, 2011; Wagner, 2008). Students today use many forms of media to socialize with one another, which increases their abilities to collaborate effectively (Jukes et al., 2010 - 2011; Lazonder, 2005; Okojie, 2011; Selwyn, 2009). Instructional technology has also made students very adaptable and agile; they can juggle many tasks at one time (Wagner, 2008). Another benefit to instructional technology is that students take initiative and become entrepreneurial by seeking out new opportunities, ideas, and strategies for improvement (Wagner, 2008). Technology has allowed students to consistently communicate orally and in writing to people from all over the world. Instructional technology has increased the amount of time students communicate with others and have access to information (Christensen, Horn, & Johnson, 2008; Selwyn, 2009; Wagner, 2008). Students' imagination, curiosity, and motivation have also improved when instructional technology was utilized (Azzam, 2009; Billig et al., 2001; Wagner, 2008).

All these perceived benefits may have a potential impact on decreasing the achievement gap for all students but especially for students with disabilities. The increased access to instructional technology may have a positive effect on the acquisition of 21st century skills for students with disabilities, which will assist them in becoming contributing members of society in inclusive settings. Oral language, vocabulary acquisition, reading comprehension, and written communication skills of students with
disabilities may be enhanced through the integration of technology (King-Sears et al., 2011). Technology has also proven to give students with disabilities the opportunity to engage in “basic drill and practice, simulations, exploratory, or communication activities that are matched to their individual needs and abilities” (Hasselbring & Glaser, 2000, p. 106). Specific technologies such as frequency-modulated (FM) amplification systems, telecommunication devices for the deaf (TDDs), and live speech captioning assist students with hearing impairments and computer screen magnification, descriptive video services, screen readers, optical character recognition allow students with visual impairments to have access to the general education curriculum (Hasselbring & Glaser, 2000). King-Sears et al. (2011) differentiated between assistive technology and instructional technology. The authors stated that "if the student needs the technology to function, it is assistive technology, and if the student benefits from using the technology but can function without it, then it is classroom technology" (p. 569 - 570). Much research emphasized that technology integration allowed for increased access to the general education curriculum for students with disabilities and supports literacy instruction (Kennedy & Deshler, 2010; King-Sears et al., 2011; Rhodes & Milby; 2007). Benefits of instructional technology promote more inclusive placements for students with disabilities.

Even though schools have integrated technological tools into their instructional goals, a variety of barriers limit the use of technology in schools. Barriers include resources such as cost, access, and time, institutional leadership, subject culture, teachers' attitudes and beliefs, lack of technological knowledge and skills, increased assessments,
and the digital divide (Collins & Halverson, 2009; Hew & Brush, 2007; Johnston & Cooley, 2001). Strategies to overcome barriers include schools developing a shared vision and technology integration plan, overcoming the scarcity of resources by exploring technology, access to available technology, time, and technical support, changing teachers' attitudes and beliefs, reconsidering assessment, and conducting professional development (Hew & Brush, 2007; Johnston & Cooley, 2001). These strategies could become the bridge that schools need to advance the integration of technological tools to meet their instructional goals.

An array of instructional technologies is available to school districts to improve student learning. Computers are sometimes the first tool that comes to mind when thinking of instructional technologies; however, cameras, CD players, PDAs, GPS devices, computer-based probes, calculators, Web 2.0 tools such as Prezi, Glogster, Slide Rocket, and online applications such as Edmodo, wikis, and blogs are other examples of instructional technologies. Technological tools can be used to search for, locate, and present information in the classroom. For students with disabilities, these technologies may also facilitate learning and increase student access to the general curriculum. Two recent applications of instructional technology with the potential to reduce the achievement gap and promote inclusive placements are gaming and one-to-one laptops.

The first section of the literature review traces the legislative history of No Child Left Behind and the Individuals with Disabilities Education Improvement Act, and describes each law's provisions to reduce the achievement gap and promote inclusive placements for students with disabilities. The potential for instructional technology to
meet the goals of both statutes is discussed, including the importance of instructional technology for students with disabilities as well as the barriers in achieving that integration. Finally, the educational benefits of gaming and one-to-one applications are presented including both academic and social gains. The chapter concludes with the purpose of the research and the research questions.

Legislation

The legislative history of both No Child Left Behind and the Individuals with Disabilities Education Improvement Act describe specific provisions to reduce the achievement gap and promote inclusive placements for students with disabilities. Responsibilities for school districts are clearly defined, including assessment and accountability requirements.

No Child Left Behind

The purpose of No Child Left Behind is to "ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessments"(P.L. 107-110 §1001). In order to meet this lofty goal, school districts must conduct annual testing, report academic progress, provide report cards, assure that teachers are highly qualified, promote reading initiative, and explore alternative funding formulae (Dee & Jacob, 2010; Guilott & Parker, 2010; No Child Left Behind, 2001; Simpson, LaCava, & Sampson Graner, 2004).

History of NCLB. In 1965 President Lyndon B. Johnson passed the Elementary and Secondary Education Act (ESEA) as part of his War on Poverty. The focus was to
provide poor schools with federal funding to assist low achieving students. ESEA included many titled programs that were linked to federal dollars to specific performance goals to ensure improved results. Title I, concentrated target on comprehensive school reform, began to help raise the basic skills and academic achievement of many disadvantaged children (Jorgensen & Hoffmann, 2003; No Child Left Behind, 2001). Title II focused on boosting teacher quality in preparation, training, and recruitment. Improving math and science instruction was an emphasis with Title II funding. Title III addressed moving limited English proficient students to English fluency and Title IV promoted parental options and innovative programs such as school choice and charter schools. Title V supported safe schools for the 21st century and part B invited school districts to incorporate educational technology to improve academic achievement. Title VI increased funds to rebuild schools for Native Americans and children from military families and Title VII encouraged freedom and accountability for each state and school district to improve student achievement measured by state assessments (No Child Left Behind, 2001).

In 1981 the National Commission on Excellence in Education was authorized to review data on the quality of learning and teaching in the nation’s schools, colleges, and universities. Their 1983 report, *A Nation at Risk*, stated,

All, regardless of race or class or economic status, are entitled to a fair chance and to the tools for developing their individual powers of mind and spirit to the utmost. This promise means that all children by virtue of their own efforts, competently guided, can hope to attain the mature and informed judgment needed to secure gainful employment, and to manage their own lives, thereby serving not only their own interests but also the progress of society itself (U.S. Department of Education, 1983, p.1).
The report focused on four critical aspects of the educational process: content, expectations, time, and teaching. The National Commission on Excellence in Education found that schools' curricula were watered down so strengthening high school graduation requirements was recommended. The report noted that the level of knowledge, abilities, and skills that graduates possessed were not satisfactory. The commission recommended that schools "adopt more rigorous and measurable standards, and higher expectations, for academic performance using challenging materials in an environment that supports learning and authentic accomplishment" (Jorgensen & Hoffmann, 2003, p. 3). The allocation of time was reviewed and the Commission recommended more effective use of instructional time and a longer school day or school year. The last aspect of the report focused on teaching. The Commission found that the teaching profession was not attracting high academic students and teacher preparation programs needed improvement (Jorgensen & Hoffmann, 2003). "A Nation at Risk was also the beginning of an evolution in achievement testing and standards-based education reform" (Jorgensen & Hoffmann, 2003, p. 3). Many changes in legislation were based on these premises.

In 1994, the reauthorization of ESEA changed the name to the Improving America's Schools Act of 1994, which focused on standards-based education and assessment as reported in A Nation at Risk. Goals 2000: Educate America Act was also passed in 1994. The focus of this law was on the needs of all students, not just the disadvantaged or children placed at risk of school failure. The themes of the 1994 ESEA were: (1) "high standards for all children; (2) a focus on teaching and learning; (3) partnerships among families, communities, and schools; (4) flexibility coupled with
responsibility for student performance; and (5) resources targeted to areas of greatest needs” (Jorgensen & Hoffmann, 2003, p. 4). Increased accountability and communication were important to reform education.

In 2002 President George W. Bush signed into law the No Child Left Behind Act of 2001 (NCLB), which reauthorized the ESEA. The reauthorized statute emphasized direct public accountability for individual student learning (Jorgensen & Hoffman, 2003). The overarching purpose of NCLB was to

ensure that high-quality academic assessments, accountability systems, teacher preparation and training, curriculum, and instructional materials are aligned with challenging state academic standards so that students, teachers, parents, and administrators can measure progress against common expectations for student academic achievement; meet the educational needs of low-achieving children in our Nation’s highest-poverty schools, limited English proficient children, migratory children, children with disabilities, Indian children, neglected or delinquent children, and young children in need of reading assistance [P.L. 107-110, §1001(1)(2)].

In order to achieve the purpose, several principles were identified.

**Principles of NCLB.** The six guiding principles to the NCLB Act are accountability for results, school safety, parental choice, teacher quality, scientifically-based methods of teaching, and local flexibility (Turnbull, Turnbull, & Wehmeyer, 2010). Of these principles, accountability for results was the focus of the statute.

Schools have an obligation to report annual state assessments for students grades 3 through 8 in math, reading, and science. NCLB stated:

each State plan shall demonstrate that the State educational agency, in consultation with local educational agencies, has implemented a set of high quality, yearly student academic assessments that include, at a minimum, academic assessments in mathematics, reading or language arts, and science that will be used as the primary means of determining the yearly performance of the State and of each local educational agency and school in the State in enabling all
children to meet the State's challenging student academic achievement standards, except that no State shall be required to meet the requirements of this part relating to science assessments until the beginning of the 2007-2008 school year [P.L. 107-110, §1111(3)(A)].

The state assessments were referred to as high-stakes tests, aligned with the state's content standards, and must be as rigorous as those of the National Assessment of Educational Progress (Guilott & Parker, 2010; Maleyko & Gawlik, 2011). The assessment results must be reported by subgroups representing students in poverty, students with limited English proficiency, students from major race and ethnicity groups, and students with disabilities. The school as a whole and all subgroups are expected to make adequate yearly progress (AYP). AYP is determined if each group of students described in subparagraph (C)(v) must meet or exceed the objectives set by the State under subparagraph (G), except that if any group described in subparagraph (C)(v) does not meet those objectives in any particular year, the school shall be considered to have made adequate yearly progress if the percentage of students in that group who did not meet or exceed the proficient level of academic achievement on the State assessments under paragraph (3) for that year decreased by 10 percent of that percentage from the preceding school year and that group made progress on one or more of the academic indicators described in subparagraph (C)(vi) or (vii) [P.L. 107-110, §1111(2)(I)(i)].

The last determination mentioned was an exception known as the "safe harbor" provision (Bartlett, Etscheidt, & Weisenstein, 2007). NCLB stated that "for the purpose of determining whether schools are making adequate yearly progress, the State may establish a uniform procedure for averaging data" [P.L. 107-110, §1111(2)(J)]. Maleyki and Gawlik (2011) claimed there are faults in determining schools' annual yearly progress. States implement different standards and measure AYP differently, which affects the number of schools that statistically meet AYP in each state. The differences in measuring AYP could include "changes in the confidence interval measurement, the
number of students in a specific subgroup, and the type of trajectory that a state employs" (Maleyki & Gawlik, 2011, p. 609). Multiple measures of determining student achievement should also be employed rather than using a single high-stakes assessment. A factor that AYP does not take into account is how the students' social capital, "parents' education levels, the values the family places on education, socioeconomic status, the peer group influence, and similar assets and liabilities" (Maleyki & Gawlik, 2011, p. 612), impacts student achievement. Failure to meet AYP results in sanctions. Each state set their own level of proficiency that all students must meet by school year 2013 – 2014 (Bartlett et al., 2007; Turnbull et al., 2010). If a school does not meet AYP for the first year, it is placed on a watch list and required to develop a school improvement plan. The school is listed as "a school in need of assistance" if it does not meet AYP for two consecutive years. Students attending such school have the option to attend another school that is making adequate yearly progress. If the school does not make progress for three consecutive years, in addition to the sanctions mentioned for years one and two, the school district must offer "supplemental educational services" to any student who qualifies for free or reduced lunch from an outside provider. The fourth year of inadequate progress requires the school to make staffing changes or restructure the school. If the school still has not made progress by year five, then it must convert to a charter school, turn management over to a private management company, or be taken over by the state (P.L. 107-110, §1116). By reporting the annual yearly progress, schools are accountable for showing increased student achievement based on the state's high-stakes assessment.
The next principle, school safety, required all schools to provide a safe learning environment for students. Schools must establish a plan for keeping schools safe and drug-free. States determine how each school will report data regarding these issues to parents and community members. Unsafe schools are described as persistently dangerous where students are victims of violent criminal offenses (No Child Left Behind, 2001). Criminal offenses could include possession of controlled substance or drugs, hate crimes, violent related expulsions, or weapon violations (P.L. 107-110, §4151). Bullying and harassment are common offenses reported by schools. Schools must learn more about the following concerns to collect and analyze data regarding school violence and safety:

(a) victimization experiences; (b) characteristics of the individuals and schools; (c) systemic factors, such as how the school’s system of rules is understood and implemented; (d) risk and protective factors across ecological levels; and (e) related contextual variables, such as neighborhood mobility or crime and violence in the local school community (Mayer & Furlong, 2010, p. 19 - 20).

"States must adopt a zero-tolerance policy for violent or persistently disruptive students" (No Child Left Behind, 2001, p. 20). If a school is deemed unsafe by the state, parents will be notified and offered an opportunity to transfer their child to a safe school (Turnbull et al., 2010).

Parental choice was the next principle of NCLB. Schools need to keep parents informed about the academic achievement of students attending that school, school safety, and qualifications of their child’s teachers. Parents should also be notified if their child is eligible to move or "transfer to another school" [P.L. 107-110, §1121(b)(7)(C)(iv)]. Parents are eligible to transfer if their current school is not making adequate progress, "considered to be ‘persistently dangerous,’ or if the child has been a
victim of a violent crime while on school grounds" (Turnbull et al., 2010, p. 22). Parents have the right to ensure their child is being educated by high-quality teachers in safe schools.

Teacher quality was the fourth principle of NCLB. The teacher must be proficient to teach the content in which they teach and meet state standards. Parents should know:

- whether the teacher has met State qualification and licensing criteria for the grade levels and subject areas in which the teacher provides instruction. Whether the teacher is teaching under emergency or other provisional status through which State qualification or licensing criteria have been waived. The baccalaureate degree major of the teacher and any other graduate certification or degree held by the teacher, and the field of discipline of the certification or degree [P.L. 107-110, §1111(6)(A)(i)(ii)(iii)].

Prior to NCLB, low income communities and high poverty schools often employed teachers who were out of the field, had less teaching experience, or may have failed the certification test to teach their students (Greenlee & Brown, 2009; Loeb, Rouse, & Shorris, 2007; Tyler, 2008). Teacher quality ensures that the best teachers are with the neediest students. In order for schools to accomplish this, high-quality teachers may need fiscal incentives, resources, or loan forgiveness programs to entice them to teach in hard-to-fill positions, such as math, science, special education, and challenging schools, such as rural and inner city (Greenlee & Brown, 2009; Loeb et al., 2007; Reece, 2004; Tyler, 2008). Paraprofessionals are also required to be highly qualified. Paraprofessionals working in programs supported by Title 1 funds must meet one of the following conditions:

- have completed at two years of postsecondary education, obtained an associate's (or higher) degree; or have met a rigorous standard of quality and can demonstrate, through a formal state or local academic assessment, knowledge of
and the ability to assist in instructing reading, writing, and mathematics (Christie, 2005, p. 181).

Qualified paraprofessionals work under the direct supervision of a teacher when providing instructional support to students. Individuals who perform noninstructional roles such as food services, and playground supervision do not need to meet the requirements of NCLB (Bartlett et al., 2007; Christie, 2005). Paraprofessionals perform many duties and should be competent in understanding specific disabilities, behavior management, working with adults, and current issues in inclusion to name a few (Dillon & Ebmeier, 2009). Having highly-qualified teachers and paraprofessionals in more schools should improve student achievement and help decrease the achievement gap.

Another guiding principle of NCLB was that highly-qualified teachers should be teaching scientifically based methods of teaching. Scientifically-based research has been defined as "methods that have met rigorous standards and that have been shown, when correctly applied, to reliably yield positive results" (Simpson et al., 2004, p. 69). The U.S. Department of Education established the What Works Clearinghouse to provide teachers with evidence-based practices that are valid and reliable. These practices are effective and "scientifically supported educational methods" (Simpson et al., 2004, p. 69) that can help ensure students' academic success. States enforce this by establishing Reading Leadership Teams that make sure schools that need to improve their reading scores are using evidence-based practices. Schools that are not making adequate student achievement goals are required to use evidence-based practices in order to stay open (Turnbull et al., 2010).
The last principle of NCLB was the idea of local flexibility. Schools have the choice to use federal funds from one program for another to help support local problems. The exception to this is that funds cannot be taken from IDEA money as that money is meant for students with disabilities (Turnbull et al., 2010). The premise behind increasing local flexibility for decision making and use of resources is that "community personnel - educators, parents, and community leaders - can best determine local needs" (Simpson et al., 2004, p. 70).

President Obama announced a flexibility package in October 2011 that provided each state an opportunity to complete a waiver application for education reform. The U.S. Department of Education invited State Education Agencies to develop “plans designed to improve educational outcomes for all students, close achievement gaps, increase equity, and improve the quality of instruction” (U.S. Department of Education, 2012). Each state solicited input from "teachers, students, parents, community-based organizations, civil-rights organizations, and business organizations" before completing its waiver (Goldmann, 2011, p. 26). Components that each state addressed in the waiver was how states will implement college and career ready standards and high-quality assessments, develop rigorous accountability systems that include a focus on low-performing schools and schools with persistent achievement gaps, improve student learning in all schools, and create comprehensive evaluation systems for principals and teachers (Goldmann, 2011; Klotz, 2011; Klotz, 2012). Eleven states filed applications in November 2011 to meet the first deadline, and more states are anticipated to file in the spring 2012 to meet
the next deadline (Klotz, 2012). Increased flexibility will allow states to reform its educational systems to best meet the needs of the students in its state.

**Provisions of NCLB.** Two major provisions of NCLB were integrating technology and addressing the achievement gap. The intent of the law was that through professional development opportunities, teachers would learn how to effectively integrate technology into their instruction, which would hopefully decrease the achievement gap and promote inclusive placements between the subgroups of students in which schools must report, including students with disabilities.

*Integration of technology resources.* The focus of this provision was on how technology resources were being used rather than simply being available in classrooms. NCLB clearly stated schools need to ensure that "teachers are prepared to integrate technology effectively into curricula and instruction" [P.L. 107-110, §2414(b)(3)(B)]. In order for administrators to evaluate that teachers were effectively doing this, teachers needed to

identify and promote curricula and teaching strategies that integrate technology effectively into curricula and instruction, based on a review of relevant research, leading to improvements in student academic achievement, as measured by challenging State academic content and student academic achievement standards [P.L. 107-110, §2414(b)(4)(a)].

Proponents of technology integration stated that students would take ownership of their learning if new technologies were integrated into the curriculum causing a more student-centered classroom environment rather than one that was teacher-directed (Collins & Halverson, 2009).
If students were having difficulties in a specific content area, technology-based supplementary services could be available to students. These technology-based resources could include "computer-based learning programs or access to online tutoring" (Collins & Halverson, 2009, p. 141). Sections 2413 - 2416 of NCLB described how States and local agencies could integrate technology to increase student achievement. These sections also identified State and local activities in which technology could be used. Section 2414 outlined the application requirements for local agency that want a new or updated strategic educational technology plan. The contents of the application required a description of how the local agency would meet 12 criteria. The first element that needed to be described was how federal funds would be used to improve the student academic achievement, including technology literacy, of all students attending schools served by the local educational agency and to improve the capacity of all teachers teaching in schools served by the local educational agency to integrate technology effectively into curricula and instruction [P.L. 107-110, §2413(b)(1)].

The next criterion needed to describe how specific technological goals were aligned with State academic content and standards to improve student academic achievement. Local agencies then had to describe how funds would be used to increase educational technology access to students and teachers. The steps needed to include how increased access would be obtained for students in high-poverty and high-needs schools as well as preparing teachers to integrate technology effectively in their instruction. The local agency then needed to identify and promote curricula and teaching strategies that integrate technology effectively into curricula and instruction, based on a review of relevant research, leading to improvements in student academic achievement, as measured by challenging State academic content and student academic achievement standards;
and provide ongoing, sustained professional development for teachers, principals, administrators, and school library media personnel serving the local educational agency, to further the effective use of technology in the classroom or library media center, including, if applicable, a list of the entities that will be partners with the local educational agency involved in providing the ongoing, sustained professional development [P.L. 107-110, §2413(b)(4)(A)(B)].

The fifth component of the application needed to specify the type and cost of technologies such as services, software, and digital curricula required to meet the goals. Descriptions regarding how the local agency would coordinate technology-related activities should have also been included. A timeline of how technological learning materials would be integrated into the curricula and instruction was the next criterion. Another component was

a description of how the applicant will encourage the development and utilization of innovative strategies for the delivery of specialized or rigorous academic courses and curricula through the use of technology, including distance learning technologies, particularly for those areas that would not otherwise have access to such courses and curricula due to geographical isolation or insufficient resources [P.L. 107-110, §2413(b)(8)].

A description of how the local agency would promote parental involvement and increase communication with parents was another component. Parents needed to be informed and educated regarding how technology was being applied in their child's education at school so parents could reinforce the instruction at home. Local agencies also had to describe how programs would be developed in collaboration with adult literacy service providers to maximize the use of technology. The eleventh component of the application needed to describe

the process and accountability measures that the applicant will use to evaluate the extent to which activities funded under this subpart are effective in integrating technology into curricula and instruction, increasing the ability of teachers to
teach, and enabling students to meet challenging State academic content and student academic achievement standards [P.L. 107-110, §2413(b)(11)].

The last criteria required was a description of supporting resources such as software and print resources, which would be acquired to ensure effective use of technology.

Section 2415 of NCLB described state activities in which technology could be used, whereas Section 2416 described local activities. State activities included

(1) developing innovative strategies for the delivery of specialized or rigorous academic courses and curricula through the use of technology, including distance learning technologies; (2) establishing or supporting public-private initiatives (such as interest-free or reduced-cost loans) for the acquisition of educational technology for high-need local educational agencies and students attending schools served by such agencies; (3) assisting in intensive, high-quality professional development based on a review of relevant research in the integration of advanced technologies, including emerging technologies, into curricula and instruction and in using those technologies to create new learning environments; (4) assisting in providing all students (including students with disabilities and students with limited English proficiency) and teachers with access to educational technology; (5) developing performance measurement systems to determine the effectiveness of educational technology programs; (6) collaborating with other State educational agencies on distance learning, including making specialized or rigorous academic courses and curricula available to students in areas that would not otherwise have access to such courses and curricula [P.L. 107-110, §2415(a)].

Section 2416 of No Child Behind identified local activities in which technology could be used and integrated into curricula and instruction. Providing professional development was the most important local activity that could be done. During professional development opportunities, teachers were to be shown how to integrate technology into their teaching as well as how to communicate and find resources using the Internet. Other local activities that could be done were

(1) establishing or expanding initiatives designed to increase access to technology for students and teachers; (2) adapting or expanding existing and new applications of technology; (3) acquiring proven and effective courses and curricula that include integrated technology; (4) utilizing technology to develop or
expand efforts to connect schools and teachers with parents and students to promote meaningful parental involvement, to foster increased communication about curricula, assignments, and assessments between students, parents, and teachers, and to assist parents to understand the technology being applied in their child's education, so that parents are able to reinforce at home the instruction their child receives at school; (5) preparing one or more teachers in elementary schools and secondary schools as technology; (6) acquiring, adapting, expanding, implementing, repairing, and maintaining existing and new applications of technology; (7) acquiring connectivity linkages, resources, and services for use by teachers, students, academic counselors, and school library media personnel in the classroom, in academic and college counseling centers, or in school library media centers; (8) using technology to collect, manage, and analyze data to inform and enhance teaching and school improvement efforts; (9) implementing performance measurement systems to determine the effectiveness of education technology programs; (10) developing, enhancing, or implementing information technology courses [P.L. 107-110, §2416(b)].

NCLB has increased the pressure on schools and teachers to effectively incorporate technology resources into the curriculum rather than just having the technology available to students. The suggested state and local activities clearly illustrate that the integration of instructional technology was intended to improve student achievement through federal funds that specify the type and cost of technology, promote curricula and teaching strategies that integrate technology, promote parental involvement and communication with parents, encourage accountability, increase professional development, and increase teachers' and students' access to technology. These efforts should assist in reducing the achievement gap and promoting the inclusion of students with disabilities.

Addressing the achievement gap. The second provision and priority of NCLB was to close the achievement gap. The achievement gap in education refers to the disparity in academic performance between groups of students. The achievement gap shows up in grades, standardized-test scores, course selection, dropout rates, and college-completion
rates (Maleyko & Gawlik, 2011; Wagner, 2008; Williams, 2003). Schools have tried many ways to reform current practices such as reducing class sizes, creating smaller schools, expanding early-childhood programs, raising academic standards, improving the quality of teachers provided to poor and minority students, and encouraging more minority students to take high-level courses (Kober, 2001; Wagner, 2008; Williams, 2003). Even after all these attempts, the achievement gap still exists among different student groups.

NCLB mandated that schools make adequate yearly progress to decrease the achievement gap. In doing so, individual states determine the proficiency level for all students. NCLB required schools to disaggregate test scores by student characteristics as a means to compare scores between student groups as well as the whole student population. Four subgroups that schools must report results for are: economically disadvantaged students, students from major racial and ethnic groups, students with disabilities, and students with limited English proficiency [P.L. 107 - 110, §1111(2)(C)(v)(II)(aa)(bb)(cc)(dd)]. This disaggregation of test scores allows schools to pinpoint which groups are making progress and which groups need remediation.

Closing the achievement gap is an investment that policymakers need to make if they want to improve the education for all children. NCLB established specific principles such as accountability for results, school safety, parental choice, teacher quality, scientifically based methods of teaching, and local flexibility so that schools provided opportunities for all students to be successful.
NCLB and implementation concerns. Although No Child Left Behind has set ambitious goals, criticisms are evident. Since the implementation of No Child Left Behind, education has moved to a standards-driven accountability system (Deubel, 2006). Some critics state that NCLB has negatively affected teachers’ creativity. Many teachers want to be innovative but hesitate at taking the risk if it does not increase student performance. Many teachers practice skills and cover the content that high-stakes tests measure. NCLB has almost forced teachers to teach to the test instead of teaching with their creative instincts (Collins & Halverson, 2009; Guilfoyle, 2006). Other critics argue that NCLB has "failed to eradicate the inequities in public education (James, 2009), due possibly to inadequate funding (Younger, 2007), structural incentives for states to lower student proficiency standards (Heise, 2007; Reichbach, 2004; Ryan, 2004), inflated test reporting (Nichols & Berliner, 2007), and a resistance to federal control of curricula (Pinder, 2008)" (as cited in Etscheidt, 2012b, p. 195). Specifically, critics insist that students with disabilities are not receiving the educational services they require because they do not realize equal educational opportunity. NCLB "forces attention on fixed accountability standards, rather than an individualized model of accountability based on reasonable growth for each student" (Keele, 2004 as cited in Etscheidt, 2012b, p. 196). NCLB makes standardized performance the most important priority rather than making progress on individualized goals. This distraction could affect the quality of how special education teachers delivery instruction to students with disabilities (Etscheidt, 2012b). These concerns have educators questioning the intent and effectiveness of NCLB.
NCLB and students with disabilities. NCLB specifically targeted the achievement gap for students with disabilities. The achievement gap for students with disabilities is the discrepancy between achievement levels between students with disabilities and students without disabilities. Typically, this gap is measured through standardized test scores on reading and math proficiency; however, it could include other educational outcomes such as graduation and dropout rates, rates of disciplinary action, or rates of postsecondary employment and higher education attendance (Iowa Department of Education, 2012).

In order to decrease this achievement gap, schools need to provide valuable resources to the students. Four critical resources that students require are "access to challenging curriculum and instruction, extra supports, high-quality teachers, and high expectations" (Williams, 2003, p. 31). Williams (1996) stated that in order to progress in closing the achievement gap, specific strategies need to be implemented by turnaround teachers and schools that include

- providing school-linked services and resources for urban communities and families; making urban schools and classrooms culturally compatible with students' home backgrounds and conditions; having teachers who communicate high expectations, caring, and cultural sensitivity; giving urban students opportunities to learn; creating school environments that foster students' resilience; and fostering high levels of teacher engagement (as cited in Williams, 2003, p. 115).

Since students with disabilities are assessed using the same challenging State student academic achievement standards (Federal Register, 2006), the previously mentioned strategies will hopefully assist students with disabilities in raising their score on such achievement tests.
Inconvenient truths of NCLB. Some say the achievement gaps result from subtle environmental factors, social capital, or opportunity gaps in the resources available to poor versus wealthy children (Maleyko & Gawlik, 2011). These problems rooted in social and economic inequalities are "more powerful than curricula, teaching practices, standardized tests, or other school-related policies" (Boyd-Zaharias & Helen, 2008, p. 40). In order to achieve a high quality education for all students, Boyd-Zaharias and Helen (2008) state that policymakers need to confront three inconvenient truths:

1. Our nation's social class inequalities are vast and growing; 2. Schools alone cannot close the achievement gap or solve the dropout problem; and 3. It is going to cost a lot of money to ameliorate the achievement-depressing social and economic condition of lower-class children's lives and to improve the public schools they attend (p. 43-44).

The first inconvenient truth is that inequalities in social class exist and are growing. Assessments of young children show an achievement gap exists before students start school (Kober, 2001). When students start school, Williams (2003) stated that a strong association exists between the socioeconomic characteristics of students and teacher satisfaction and engagement with teaching. Teachers believe that students from middle to upper class were more engaged and responsive in their teaching compared to students from the lower socioeconomic class. For this reason, many teachers prefer to teach students who came from middle to upper class families, which make it difficult for schools to attract high-quality teachers (Tyler, 2008).

The next inconvenient truth is that schools alone cannot close the achievement gap. "There is no simple explanation for the achievement gap. A variety of school, community, and home factors seems to underlie or contribute to the gap" (Kober, 2001,
p. 11), such as poverty, discrimination, and home and community learning opportunities. Racial and ethnic differences in family income also contribute some to the achievement gap. Teachers can instruct students in the classroom, but cannot make the students learn. Larger political and social movements that can alter systemic deficiencies in school systems and society may have a greater effect on closing the achievement gap than schools alone (Williams, 2003).

The last inconvenient truth explains that a significant financial investment will be necessary to improve lower-class children's lives and the public schools they attend. Policymakers can take the following actions to close the achievement gap with a sufficient amount of funding:

- ensure an adequate supply of well-qualified teachers in high-minority schools;
- expand access to advanced courses and rigorous instruction in high-minority schools;
- equalize resources among poor and affluent schools and provide additional resources to high-minority and high-poverty schools;
- and address other disparities in curriculum, instruction, and facilities between high-minority and low-minority schools (Kober, 2001, p. 6).

NCLB stresses increased accountability, flexibility, and choice for all children. Despite these criticisms, an important focus of the statute was to address the achievement gap for students with disabilities and promote more inclusive placements. Another major law, Individuals with Disabilities Education Act (IDEA), parallels many of the goals outlined in NCLB. The goals in IDEA were specific to students with disabilities, however, consistent with the goals that NCLB has for all children (Weishaar, Borsa, & Weishaar, 2007).
Individuals with Disabilities Education Act (IDEA)

The Individuals with Disabilities Education Act is a law protecting individuals with disabilities from birth through age 21. Infants and toddlers with disabilities (birth-2) and their families receive early intervention services under IDEA Part C, whereas children and youth (ages 3-21) receive special education and related services under IDEA Part B. IDEA governs how states and public agencies provide early intervention, special education and related services to eligible individuals (U.S. Department of Education, 2012). The purpose of IDEA is “to provide students with disabilities an appropriate education that prepares them for further education, employment, independent living” [20 U.S.C. §1414(d)(1)(a)].

History of IDEA. Prior to the passage of the Education for All Handicapped Children Act (Public Law 94 – 142) in 1975, children with disabilities were denied access to a free, appropriate, public education, opportunities to learn, and lived in state institutions (Bartlett et al., 2007; Turnbull et al., 2010). In the early 20th century, community-based programs and teacher trainings for working with students with disabilities began. Many students with disabilities were still “segregated along categorical lines and separate from regular classes and schools” (Bartlett et al., 2007, p. 5). Between World War II and the Civil Rights Movement, there was a change in philosophy from segregated schools to integration and “normalization” of individuals with and without disabilities (Bartlett et al., 2007).

Two major court cases that assisted in the passage of the Education for All Handicapped Children Act were the Pennsylvania Association for Retarded Citizens
(PARC) v. Pennsylvania (1971/1972) and Mills v. Board of Education (1972) which both advocated for a "right to education." PARC advocated that individuals with mental retardation should have access to a public education. The civil action case of Mills sought to have seven students with disabilities gain access to their neighboring schools. These two court cases set precedents for the rights of individuals with disabilities. Many of the rulings from these cases were included into federal statute (Bartlett et al., 2007; Etscheidt, 2012b).

In 1975, the Education for All Handicapped Children Act (EAHCA) was passed, which guaranteed a free, appropriate public education to individuals with disabilities across the country. Since 1975, EAHCA has been reviewed and reauthorized from the original special education law five times. In 1983, EAHCA started the preparation of students with disabilities for vocational success through transition programs (Rusch, 2008). This held schools and students with disabilities accountable in acquiring the skills necessary to be successful contributing members of society after high school. In 1986 there was a strong push from Madeline Will, Assistant Secretary of Education and head of the Office of Special Education and Rehabilitation Services (OSERS) to include students with disabilities in regular education settings. Will stated, “Education in the Least Restrictive Environment is what I envision as the last barrier to full implementation of P.L. 94 – 142” (Aldersley, 2002, p. 1). As a result of several rulings from federal circuit court of appeals in interpreting the concept of “least restrictive environment,” the inclusion movement gained significant momentum (Bartlett et al., 2007).
The reauthorization of EAHCA in 1990 changed the name of the law to the Individuals with Disabilities Education Act (IDEA) replacing the word handicapped with disability (Bartlett et al., 2007; Blackbourn, Patton, & Trainor, 2004; Hallahan, Kauffman, & Pullen, 2012). In addition, two other disabling conditions, autism and traumatic brain injury, became categories that IDEA would protect. Attention deficit/hyperactivity disorder was not added as a specific category; however, in this reauthorization, it was considered a disability that would fall under the IDEA category of “Other Health Impaired” (Blackbourn et al., 2004). In order to reduce special education referrals for minority students, the U.S. Department of Education introduced pre-referral interventions to identify instructional problems. These problems were identified through classroom data collection by general education teachers to meet the needs of difficult to teach students (Etscheidt, 2012a). By having general education teachers collect data in the general education classroom, it allowed students, who may be eligible for special education, to remain in the least restrictive environment until data showed the need for a more restrictive placement.

The 1997 reauthorization focused on transition services from high school to adult living. Currently, special education teachers have to include transition plans for high school students beginning at age 14 that address living, learning, and working goals that will prepare the students for life after high school (Rusch, 2008). In addition to transition planning, Congress began to emphasize quality public education programs and improving and evaluating student performance rather than just implementing educational programs and services (Bartlett et al., 2007; Turnbull et al., 2010). Congress declared an outcome-
based accountability system that would improve education results for students with disabilities by "ensuring equal opportunity, full participation, independent living, and economic self-efficiency" (Turnbull et al., 2010, p. 24). In the 1997 Amendments to IDEA, supplementary aids and services were defined for the first time as "aids, services, and other supports that are provided in regular education classes or other education-related settings to enable children with disabilities to be educated with nondisabled children to the maximum extent appropriate" [20 U.S.C. §1401(29)].

The 2004 reauthorization of IDEA changed the law to Individuals with Disabilities Education Improvement Act (IDEIA); however, the basic requirements of the law have not changed. Many people still refer to the law as IDEA or IDEA 2004. The major change during this reauthorization was to align requirements of IDEA with NCLB (Etscheidt, 2012b). Many references to NCLB were made in IDEA 2004 such as:

- the participation of children with disabilities in state and district assessment systems, goals for children with disabilities that reflected goals for all children, the flexible use of funds from the IDEA to carry out school-wide programs under the NCLB, and a mandate that all personnel were adequately prepared to work with children, subject to the provisions in the NCLB (Weishaar et al., 2007, p. 38).

The focus was to maintain consistent expectations for students with disabilities and students without disabilities. These expectations clearly indicated that student achievement was evident through AYP reporting as well as progress monitoring of IEP goals (Federal Register, 2006). The President's Commission on Excellence in Special Education (2002) recommended that this reauthorization be changed from the overreliance on the discrepancy model to identify students with learning disabilities. Rather, the Commission suggested that students respond to scientifically based
instruction “to prevent the wrong children from being served” in special education (p. 26). IDEA specified the evaluation procedures for determining eligibility. Section 300.309 delineates these procedures for determining special education eligibility as

The child does not make sufficient progress to meet age or State approved grade-level standards in one or more of the areas identified in paragraph (a)(1) of this section when using a process based on the child’s response to scientific, research-based intervention; or (ii) The child exhibits a pattern of strengths and weaknesses in performance, achievement, or both, relative to age, State-approved grade level standards, or intellectual development, that is determined by the group to be relevant to the identification of a specific learning disability, using appropriate assessments, consistent with §300.304 and 300.305 [Federal Register, 2006, p. 248 §300.309(a)(2)(i)(ii)].

The alignment of NCLB and IDEA addressed "the national need to improve educational outcomes for all students and the rights of students with disabilities to an appropriate and beneficial educational program" (Etscheidt, 2012b, p. 197). Just as NCLB outlined guiding principles, IDEA also has principles that assist in its implementation.

Provisions of IDEA. IDEA includes six principles that govern students’ education: zero reject, nondiscriminatory evaluation, appropriate education, least restrictive environment, procedural due process, and parental and student participation. Zero reject means that schools must identify and provide students with disabilities a free, appropriate, public education. School districts must find children who potentially meet the eligibility requirements of IDEA. These children could be homeless, wards of the state, or attend a private school (Bartlett et al., 2007). Nondiscriminatory evaluations allow the student to be evaluated fairly to determine if he/she has a disability and to what extent. A free, appropriate, public education (FAPE) requires schools to provide individually tailored instruction based on the evaluation. The least restrictive
environment (LRE) requires schools to educate students with disabilities alongside students without disabilities to the maximum extent appropriate. Procedural due process provides safeguards to the students and parents against the schools’ actions. Lastly, parental and student participation simply means that schools have to collaborate with parents and students when carrying out specially designed instruction (Turnbull et al., 2010). Of these six principles, the least restrictive environment mandate has generated the most interest and controversy.

Least restrictive environment. Inclusion is “a philosophy of acceptance, belonging and community” (Moore, Gilbreath, & Maiuri, 1998, p. 2) that requires a structured general education classroom to meet the diverse needs of all the students. IDEA does not define inclusion nor does it describe an inclusive environment. Rather, the law defines a continuum of placement options for students with disabilities. The placement options on the continuum range from the least restrictive general education classroom to the most restrictive home or hospital placement. Placements that fall between these two extremes could be: general and special education teachers co-teaching in the general education classroom, part-day regular education/part-day resource, part-day regular education/part-day special class, full-day placement in special class with social integration, full-day placement in a special school, or full-day placement in a residential facility (Lewis & Doorlag, 2011). “However, the intent of the law is that the rightful place for educating students, regardless of special need, is with neighborhood peers in a regular education classroom setting unless that setting is inappropriate” (Southwest Educational
In determining placement options, the decision is guided by the least restrictive environment mandate that states:

to the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are not disabled, and special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occurs only when the nature or severity of the disability of a child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily [34 C.F.R § 300.114(a)(2)(i)(ii)] (italics added).

Importantly, the consideration for supplementary aides and services to support inclusive placements is a key factor in placement decisions.

**Supplementary aids and services.** IDEA requirements clearly state that teachers are required to teach students with disabilities in the least restrictive environment by providing appropriate supplementary aids and services. Supplementary aids and services means

aids, services, and other supports that are provided in regular education classes, other education-related settings, and in extracurricular and nonacademic settings, to enable children with disabilities to be educated with nondisabled children to the maximum extent appropriate in accordance with § 300.114 through 300.116 (34 C.F.R § 300.42).

Individualized Education Program (IEP) teams have difficulty discussing and determining supplementary aids and services for students with disabilities because a comprehensive and systematic process to make that determination has not been established.

Etscheidt and Bartlett (1999) proposed four steps that IEP teams should follow when determining appropriate supplementary aids and services. The first step is to review the child's IEP. IEP teams should know the needs of the child and write individualized
goals that focus on meeting those needs. The next step is for the IEP team to discuss supplemental aids and services. In doing this, the IEP team has to evaluate the physical, instructional, social-behavioral, and collaborative dimensions. The physical dimension pertains to the physical environment such as "mobility, room arrangement, acoustics, light, or seating" (Etscheidt & Bartlett, 1999, p. 169) that may affect the child. The instructional dimension relates to "lesson planning and delivery, methodology, and assessment" (p. 170). The social-behavioral dimension "requires the team to consider aids and services that could enhance appropriate behavior and reduce disruptive, interfering behavior" (p. 170). The collaborative dimension pertains to personnel resources the child may need such as a paraprofessional, co-taught classroom, or additional instruction. The "other" dimension suggests that the IEP team consider any other factors that may not have fallen in one of the four previously mentioned dimensions.

The third step in determining appropriate supplementary aids and services is to document the decision-making process and product. This documentation needs to include "(a) the supplementary aids and services discussed and considered; (b) who will provide the agreed-upon aids and services; (c) the anticipated benefits, both academic and nonacademic, and potential disruptive effects of a regular education classroom placement; and (d) the placement decision" (Etscheidt & Bartlett, 1999, p. 171). The final step in this process is to determine the data collection procedures. This includes progress monitoring of IEP goals through observations and products as well as when to collect the data and the person responsible for data collection (Etscheidt & Bartlett, 1999). With this process in place, IEP teams should be able to discuss, determine, and document adequate
supplementary aids and services so students with disabilities can be educated in the regular education classroom.

Least restrictive environment (LRE) and supplementary aids and services (SAS) are provisions under IDEA that are meant to ensure that students with disabilities are educated with their nondisabled peers to the greatest extent possible (Federal Register, 2006). Yet, the sufficiency of school districts' efforts to provide supplementary aids and services to facilitate education in the least restrictive environment have been challenged in thousands of due process hearings and court cases since the law's inception. Six of these least restrictive environment and supplementary aids and services court cases are considered landmarks.

Court cases involving least restrictive environment and supplementary aids and services.

Daniel R.R. v. State Board of Education (1989). At the time of this case, Daniel was a 6-year-old boy with Down Syndrome who attended El Paso Independent School District (EPISD). In 1987 Daniel's developmental age was between two and three years, and his communication skills were slightly less than those of a 2-year-old.

In 1985, Daniel’s parents enrolled him in EPISD’s Early Childhood Program, a half-day program devoted entirely to special education. Before the next school year, Daniel’s parents requested that Daniel have a new placement in a half-day, regular education pre-kindergarten class so he could interact with his nondisabled peers. The district complied with the parent’s request and placed him half-day in a regular pre-
kindergarten class and the remainder of the day in the previous early childhood special education program.

Soon after this change of placement, the regular education pre-kindergarten teacher, Mrs. Norton, had reservations about Daniel’s presence. Daniel did not participate without constant, individual attention from the teacher or aide, and failed to master any of the skills Mrs. Norton was trying to teach her students. In November 1986, EPISD’s Admission, Review and Dismissal Committee met and determined that Daniel’s pre-kindergarten placement was inappropriate for him and decided to change his placement. Under the new suggested placement, Daniel would only attend the early childhood special education class. In this placement Daniel could eat lunch with his nondisabled peers three days a week only if his mother was present. Daniel also had contact with his nondisabled peer during recess.

Daniel’s parents appealed the school’s recommendation and requested a hearing. The conclusion of the hearing was that Daniel could not attend the pre-kindergarten class without constant attention, and he was receiving little educational benefit; therefore, the pre-kindergarten class was not the appropriate placement for Daniel.

Daniel’s parents appealed to the district court and the U.S. Court of Appeals, Fifth Circuit. Both courts agreed with the lower court for four reasons: (1) EPISD altered 90 to 100 percent of the curriculum to meet Daniel’s needs, a modified curriculum beyond recognition, which still did not meet all Daniel’s needs; (2) Daniel received little educational benefit in pre-kindergarten. The curriculum was developmental in nature and included communication skills and gross motor skills. Because of his slowed
development, Daniel was not ready to learn those skills; (3) Daniel’s overall educational experience had not been entirely beneficial. Experts of the case stated that a full day program was too strenuous for a child with Daniel’s condition; and (4) Daniel’s presence in regular pre-kindergarten was unfair to the rest of the class because of the amount of time the teacher had to devote specifically to Daniel (Daniel R.R. v. State Board of Education, 874 F.2d 1036, 5th Circuit, 1989).

Based on Etscheidt and Bartlett’s (1999) dimensional approach in determining supplementary aids and services, the school district considered the instructional dimension in this case. The school did provide supplementary aids and services to Daniel; however, Daniel required more assistance and supplementary aids and services than what the general education teacher could appropriately offer. Because of this, Daniel received little academic benefit. As a result, the general education classroom was not the least restrictive environment for Daniel even after supplementary aids and services were provided. Had the school district considered the additional dimension of collaboration, which could have included a paraeducator or co-teacher, Daniel’s academic benefit could have increased.

Greer v. Rome City School District (1991). Christy Greer was a 10-year-old girl with Down Syndrome at the time of this case. In 1986, when Christy was 5-years-old, her parents wanted to register her in the kindergarten program at the neighborhood school. The school district wanted to evaluate Christy and her parents resisted for fear that their daughter would be placed in a segregated special education program outside their
neighborhood school. Christy’s parents opted to keep her at home and prepare her for kindergarten the following year.

In 1988 when Christy was seven, her parents tried to enroll Christy to the neighborhood school again only to have the school request that Christy be evaluated. The school district initiated administrative proceedings so they could evaluate Christy. During this time, Christy was attending the regular kindergarten class at her neighborhood school. The hearing officer did favor the school and required that Christy was evaluated. The results of the evaluation showed that Christy functioned like a “moderately mentally handicapped child,” and she had “significant deficits in language and articulation skills” (Greer v. Rome City School District, 1991). The evaluators recommended speech and language services be provided to Christy in a highly individualized instructional setting utilizing multisensory teaching strategies.

In January 1989, an IEP meeting was convened for Christy. The school district had written an IEP and presented it to Christy’s parents. The school proposed sending Christy to another school where she would attend a self-contained class with social integration though physical education, music, and lunch. Christy’s parents disagreed with this placement and sought an independent evaluation to get a second opinion. This psychologist did express concern in placing Christy in a self-contained classroom as she would not have appropriate peer models to imitate and intellectually stimulate her.

Christy’s parents met with the school again and proposed that Christy remain in the regular kindergarten class with supplemental instruction provided from the speech
therapist. The school and parents were on opposite ends of the LRE continuum and would not negotiate.

The school district again initiated administrative proceedings to determine the most appropriate setting for Christy. Over the next two years, the case was heard by the U.S. District Court and the 11th Circuit Court of Appeals. During this time, Christy remained in the regular classroom at her neighborhood school as per the stay put provision of IDEA. Throughout the two years, Christy had made academic progress, was no longer disruptive, and no longer required a large amount of the teacher's attention. This evidence proved that Christy could be educated in the regular classroom with appropriate use of supplemental aids and services. The court determined that the self-contained classroom at another school was not the least restrictive environment for Christy.

The decision of this case was based on the two-part test from the Rowley v. Board of Education Supreme Court case. The two-part test asks whether education in the regular classroom, with the use of supplemental aids and services, can be achieved satisfactorily. If it cannot and the school intends to provide special education or to remove the child from regular education, we ask, second, whether the school has mainstreamed the child to the maximum extent appropriate (Greer v. Rome City School District, 1991).

The conclusion was that the school board failed to meet the first part of the two-part test. School officials failed to consider the full range of supplemental aids and services to provide Christy a free, appropriate public education in the least restrictive environment (Greer v. Rome City School District, 1991).
Based on Etscheidt and Bartlett's (1999) dimensional approach in determining supplementary aids and services, the school district neglected to consider the instructional dimension in this case. The school district failed to consider any supports that may have benefited Christy in the general education classroom. In addition, Christy was not receiving nonacademic benefits such as positive interaction with her nondisabled peers. Had the school district tried supplementary aids and services to ensure that Christy was educated with her nondisabled peers to the greatest extent possible, the court's decision may have differed.

Oberti v. the Board of Education of the Borough of Clementon School District (1993). Rafael Oberti was an 8-year-old child with Down's syndrome when this case began. Rafael's parents had Rafael evaluated prior to kindergarten to determine an appropriate placement for him and to comply with the federal and state law. Based on the results of the evaluation, it was recommended that Rafael be placed in a segregated special education classroom located in another school district. His parents visited many of those schools and found them all to be unacceptable for Rafael. The Obertis and neighborhood school district came to an agreement that Rafael would be placed in a developmental kindergarten class in the mornings and a special education class in another school district in the afternoons.

During Rafael's developmental kindergarten placement, his goals were to observe, model and socialize with his nondisabled peers. Rafael did make academic and social progress in this placement; however, serious behavioral problems occurred such as "toileting accidents, temper tantrums, crawling and hiding under furniture, and touching,
hitting and spitting on other children” (Oberti v. Board of Education of Clementon School District, 1993). These problems caused a disruption to the classroom and frustrated the teacher.

In the 1990 – 1991 school year, the Child Study Team recommended that Rafael be placed in a segregated special education class in another school district. This decision was made based on Rafael’s disruptive behaviors the year before. The Obertis objected to this placement and requested a due process hearing. Through mediation, it was decided that Rafael would attend a special education class in a school 45 minutes away. During this time, the school promised to explore ways to mainstream Rafael back into the regular classroom at the neighborhood school. By December 1990, Rafael’s disruptive behaviors decreased, and he was making academic progress. The Obertis found out that the school district was not making any attempt to mainstream Rafael and in Rafael’s current placement, he didn’t have any meaningful contact with nondisabled peers.

The Obertis brought another due process complaint stating the school district had not followed their promise in mainstreaming Rafael. The Administrative Law Judge (ALJ) affirmed that the segregated special education classroom was the least restrictive environment for Rafael. Based on the testimony of Rafael’s previous kindergarten teacher and the school district, the ALJ found that Rafael was achieving no educational benefit in the mainstreaming classroom. The ALJ concluded that Rafael was not ready to be mainstreamed.

The Obertis appealed to the district court. The Obertis brought in two experts who testified that with appropriate supplementary aids and services and teacher training,
Rafael could be educated in the regular education classroom. In addition, Rafael could develop appropriate social skills by observing nondisabled peers. The burden of proof was on the school district and they failed to provide enough evidence that Rafael could not be educated in the regular education classroom with supplementary aids and services. The district court concluded that the school district violated IDEA.

The court based its decision on the two-part test for determining whether a school was compliant with IDEA's mainstreaming requirement derived from Daniel R.R. v. State Board of Education case. It was decided that the school district failed to comply with the first part of the two-part test, "whether the school district has made reasonable efforts to accommodate the child in a regular classroom with supplementary aids and services" (Oberti v. Board of Education of Clementon School District, 1993). Since two years had passed since the start of the court case, nothing suggested that in time Rafael would present similar behaviors if provided with supplementary aids and services.

Similar to Greer, the school district neglected to consider the instructional and social-behavioral dimensions in considering supplementary aids and services (Etscheidt & Bartlett, 1999). The lack of behavioral supports provided to Rafael prohibited him from being successfully included in the general education classroom. The federal court stated that "inclusion is a right, not a privilege for a select few" (Oberti v. Board of Education, 1992). Supplementary aids and services needed to be provided for Rafael's behavior so he could have been educated with his nondisabled peers to the greatest extent possible.
Sacramento City Unified School District, Board of Education v. Rachel Holland (1994). Rachel Holland was an 11-year-old girl who was tested with an IQ of 44. Prior to the case, Rachel was educated in a variety of special education programs in the district from 1985 - 1989. In the fall of 1989, Rachel's parents requested that Rachel be placed in a regular classroom all day for the 1989 - 1990 school year. The school district rejected this request and proposed placing Rachel between a special education class for academic subjects and the regular class for nonacademics such as art, music, lunch, and recess. This would require Rachel to move six times throughout the day. Instead, Rachel's parents chose to enroll her in a regular kindergarten class at a private school. Rachel remained in this placement until this case reached a decision, at which time, Rachel was in second grade.

The Hollands requested a due process hearing. They disagreed with the school district as to what the proper educational placement was for Rachel. The school district claimed that Rachel was "too severely disabled to benefit from full-time placement in a regular class," whereas the Hollands stated "Rachel best learned social and academic skills in a regular classroom" (Sacramento City School District v. Rachel H., 1994). The hearing officer concluded that the school district did not make an adequate effort to educate Rachel in the least restrictive environment as stated in IDEA. The officer found:

Rachel had benefitted from her regular kindergarten class - that she was motivated to learn and learned by imitation and modeling; Rachel was not disruptive in a regular classroom; and the District had overstated the cost of putting Rachel in regular education - that the cost would not be so great that it weighed against placing her in a regular classroom (Sacramento City School District v. Rachel H., 1994).

The school district did not agree with this decision and appealed to the district court.
In determining compliance with IDEA's mainstreaming requirement, the district court used a four-factor test. The four-factor test made the court consider (1) the educational benefits of a full-time placement in a regular class; (2) the non-academic benefits of such placement; (3) the effect Rachel had on the teacher and children in the regular class; and (4) the costs of mainstreaming Rachel (Sacramento City School District v. Rachel H., 1994). The court found that Rachel was making academic progress on her IEP goals in the regular classroom as testified by Rachel's current teacher. The court determined that all of Rachel's IEP goals could be implemented in a regular classroom with supplementary aids and services. The second factor, nonacademic benefits, also favored Rachel in being in the regular education classroom. She developed social and communication skills and her self-confidence improved. The next factor, Rachel's effect on the teacher and children in the regular education classroom, also was held in her favor. Rachel's current teacher stated that Rachel did not disrupt her teaching and in the future, Rachel would only require a part-time aide. The last factor placed the burden of proof on the school district. The district did not provide any evidence that compared what it would cost to educate Rachel in a special education setting compared to the regular classroom. After considering the four-part test, the district court determined that the appropriate placement for Rachel was full-time in a regular second grade classroom with some supplemental services.

Based on Etscheidt and Bartlett's (1999) dimensional approach in determining supplementary aids and services, the school district did not consider the collaborative dimension in this case. As stated by the regular education teacher, if Rachel had been
offered a paraeducator for parts of the day, Rachel would have gained academic and
nonacademic benefits. The paraeducator would have been considered Rachel's
supplementary aid or service that would have enabled her to be educated with her
nondisabled peers. Peer modeling allowed Rachel to see her peers model appropriate
behavior. This was extremely important for Rachel because she learned from her positive
role models.

Clyde K. v. Puyallup School District (1994). Clyde K. was the father of Ryan K.,
a 15-year-old boy with Tourette's Syndrome and Attention Deficit Hyperactivity
Disorder. Prior to this litigation, Ryan was receiving special education services while
being mainstreamed into the regular classroom at Ballou Junior High School in the
behaviors such as "taunting other students with name-calling and profanity, insulting
teachers with vulgar comments, directing sexually-explicit remarks at female students,
refusing to follow directions, and kicking and hitting classroom furniture" (Clyde K. v.
Puyallup School District, 1994). Ryan also was involved in several violent confrontations
which resulted in suspensions and ultimately an expulsion after he assaulted a staff
member.

Ryan's parents met with school officials and determined that it was not safe for
Ryan to remain at Ballou Junior High School. Ryan's teachers and school administrators
met to discuss alternative educational placements. They suggested placing Ryan
temporarily in an off-campus, self-contained program called Students Temporarily Away
from Regular School (STARS). On March 17, 1992, the school district notified Ryan's
parents about placing Ryan in STARS until he could safely be reintegrated into the regular school programs.

Ryan's parents agreed with the initial placement change and then had second thoughts. On March 27, 1992, Ryan's parents requested a due process hearing as they rejected the placement at STARS. The administrative law judge in the due process hearing ruled in favor of the school district stating that they complied with IDEA. The school district provided supplementary services and made reasonable accommodations for Ryan's disability. The parents then appealed this decision to the district court.

It was decided by the district court that Ryan's parents had the burden of proof as they appealed the administrative ruling. While this case was going on, Ryan was under the "stay put provision" that stated he needed to remain in his current educational setting until a decision was made. At this time, his educational setting was the STARS placement.

Ryan's parents alleged various procedural violations of the IDEA. For each allegation, the district court found that the school district did not violate IDEA. The district court then used the four-part test to determine whether a student with a disability's placement represents the least restrictive environment. This is the same district court that used the four-part test seven months earlier in the Sacramento City Unified School District v. Rachel Holland case.

The results of the four-part test showed that Ryan was no longer receiving any academic benefit from being mainstreamed. Test results actually indicated a decline in academic achievement throughout the 1991 - 1992 school year. The second factor also
showed that Ryan was receiving minimal nonacademic benefits from his nondisabled peers. Ryan's doctor found that Ryan was socially isolated, had few friends, and suffered from stress caused by other students teasing him. The third factor indicated that Ryan had an overwhelming negative effect on his teacher and other students. Ryan became dangerously aggressive and directed sexually-explicit remarks to female students which created an unsafe learning environment for other students. The last factor, cost, was not an issue in this case. The district court concluded that STARS was Ryan's least restrictive environment until his behaviors improved. In this case it was the school district's obligation to secure a safe learning environment for Ryan and his peers.

The school district did consider the physical dimension in determining supplemental aids and services (Etscheidt & Bartlett, 1999). This case illustrated a team that adequately considered supplementary aids and services. The teachers and staff attended a special training session designed to educate them on Tourette's Syndrome, Ryan received maximum support from the school's special education staff as well as assistance from the school's behavioral specialist, and the school designated a special area in the nurse's office for Ryan to relieve his tics. This team followed the legal requirements in providing appropriate supplementary aids and services to Ryan. However, even after implementing the aforementioned supports, the general education classroom was determined not to be the least restrictive environment for Ryan.

Gregory in Golden High School where he participated in the Challenge Program, P.E. Plus, and job site training, all of which were not available at Gregory's neighborhood school. Gregory's parents consented to this placement believing it was only until the end of the school year; however, Gregory attended Golden High School until he was 21 and no longer eligible for services under IDEA.

In February 1992, Gregory's IEP recommended that the Challenge Program at Golden High School was the least restrictive environment for Gregory. Gregory's parents were not at the conference because of work obligations so they were unable to discuss their concerns. Gregory's parents sought an Impartial Hearing Officer (IHO) arguing the school district (1) violated Gregory's right to a free appropriate public education; (2) assigned Gregory to a school that he would not have attended if he had not been disabled; and (3) failed to assess Gregory's need for, make IEP provision for, and provide transition services. The IHO determined that the school district failed to provide Gregory a free appropriate public education because his IEP did not provide a statement of transition services. Even though the transition service statement wasn't included in the IEP, the IHO did state that the Challenge Program provided Gregory with educational benefit. The IHO directed the school district to schedule a meeting with Gregory's parents to create a new IEP so they could consent to the IEP. The school district appealed several aspects of the IHO's decision to an administrative law judge (ALJ).

The ALJ did agree with the IHO that the school district needed to create a new IEP with the parents' consent. The ALJ disagreed that Gregory was entitled to placement in his neighborhood school as a matter of law.
In May 1993, a new IEP was developed again assigning Gregory to the Challenge Program at Golden High School. Prior to this in April, Gregory filed action in the district court. "In its summary judgment order, the court concluded that Gregory was receiving a free appropriate public education at Golden High School, and noted that Gregory has no right, as a matter of law, to placement at his neighborhood school under either IDEA or the Rehabilitation Act" (Urban v. Jefferson County School District, 1994). It was founded that the school district did meet the requirements of IDEA. The Challenge Program at Golden High School was the least restrictive environment for Gregory where he received an appropriate education even though it was not in his neighborhood school.

Based on Etscheidt and Bartlett's (1999) dimensional approach in determining supplementary aids and services, the school district considered the physical dimension in this case and neglected to address the transition services as part of the instructional dimension. Because of Gregory's age and the school's obligation to provide a free appropriate public education, transition services needed to be considered. The school district neglected to consider any supplementary aids and services that could have benefited Gregory in receiving transition services in the least restrictive environment so that he could be included with his nondisabled peers to the maximum extent possible.

Summary of cases. These cases illustrate that school districts must ensure students with disabilities are educated in the least restrictive environment to the maximum extent appropriate. IEP teams must determine the appropriate educational environment that will improve both the academic achievement and the social relationships for students with disabilities (Palley, 2006). Failure to place students appropriately on the continuum has
resulted in minimal educational and non-educational benefits for both students with and without disabilities. The six landmark cases also illustrate that IEP teams must explore supplementary aids and services to support the education of students with disabilities in inclusive settings. Teams should identify appropriate dimensions in determining supplementary aids and services which include the physical, instructional, social-behavioral, and collaborative dimensions.

*Access and accountability.* Another major provision of IDEA is that students with disabilities have access to the general education curriculum. The delivery of instruction has "to ensure access of the child to the general curriculum, so that the child can meet the educational standards within the jurisdiction of the public agency that apply to all children" [34 C.F.R. §300.39(b)(3)(ii)]. There are specific components of the IEP that address students' access to the general education curriculum. These components include a statement describing "how the child's disability affects the child's involvement with and progress in the general curriculum" [34 C.F.R. §300.320(a)(1)], "a statement of measurable goals to enable the child to be involved with and progress in the general curriculum" [Etscheidt, 2012b, p. 198; 34 C.F.R. §300.320(2)(1)(A)], and a "statement of the services, program modifications, and supports necessary for the child to be involved with and progress in the general curriculum" [Etscheidt, 2012b, p. 198; 34 C.F.R. §300.320(4)(ii)]. These statements regarding access to the general education curriculum were relevant in order to determine appropriate accommodations for the child to participate in the general education classroom to the maximum extent appropriate.

"Access to the general education curriculum is not defined as access to the physical
location of general education or access to the content standards, but rather by multiple dimensions, including student progress" (Etscheidt, 2012b, p. 198). Special education teachers are required to frequently monitor students' progress towards meeting their IEP goals [34 C.F.R. §300.320(3)(ii)]. This constant progress monitoring assists IEP teams in addressing any lack of expected progress toward the student's annual goals as well as evaluating the effectiveness of the curriculum being used to meet those goals. Program monitoring is essential in determining the appropriateness of the student's program (Etscheidt, 2012b). IEP teams do need to specify the who, where, and when of progress monitoring through multiple measures. This includes measuring both academic and behavioral goals (Etscheidt, 2006 as cited in Etscheidt, 2012b). Progress monitoring not only holds the students accountable for learning, but also holds the teacher accountable for using an appropriate curriculum to help the student meet his/her IEP goals. IDEA 2004 aligned the goals for students with disabilities with the accountability requirements for students without disabilities. Students with disabilities take the tests that align with the general education standards to determine how much individual achievement gains students made. With the use of appropriate supplementary aids and services, students with disabilities can benefit educationally from general education instruction (Etscheidt, 2012b). This access to the general education curriculum could be facilitated through assistive or instructional technologies.

Access and accountability are two important provisions of IDEA that ensures students with disabilities have access to an appropriate education in the least restrictive environment. These provisions can be enhanced through the use of instructional
technology. The general education teacher could use technology to better meet the needs of the student with disabilities. Instructional or assistive technology can be seen as supplementary aids and services that allow students with disabilities to be educated with their nondisabled peers to the maximum extent appropriate.

Summary of Legislation

Two important pieces of legislation require that all students, including students with disabilities, achieve at high levels. NCLB requires student proficiency in core content areas and that the achievement gap between students is reduced. NCLB emphasizes the improvement of student achievement through the integration of technology resources with standards-based curricula. The goal of enhancing education through technology is central to the legislation. The other important legislative piece, IDEA, requires that students with disabilities be educated in the least restrictive environment and that IEP teams consider supplementary aids and services to promote achievement in inclusive settings. IEP teams need to consider assistive technology or other forms of instructional technology to ensure students with disabilities are included in the least restrictive environment. These technologies could be required as supplementary aids and services for a child [34 C.F.A §300.105(a)(3)]. Instructional or educational technology should be considered as a supplementary aid or service to promote successful inclusive educational environments for students with disabilities. Instructional technology could meet the objectives of both pieces of legislation: (1) to decrease the achievement gap between students with special needs and their nondisabled peers through technology
integration, and (2) to ensure that students with disabilities are educated in least-restrictive, inclusive settings.

**Instructional Technology**

Early definitions of instructional technology focused on instructional media such as films, pictures, and lantern slides. Instructional technology was a visual means for students to acquire knowledge. During the late 1920s through the 1940s, the focus shifted from visual instruction to audiovisual instruction. Sound recordings, radio broadcasting, motion pictures with sound, and the growth of television caused this shift of instructional media. Since the 1950s, several different definitions of instructional technology emerged that focused on the process of learning based on research, the technological instruments used, and the teachers' design and implementation. Some definitions used the term *instructional technology*, whereas other definitions used the term *educational technology* (Reiser & Dempsey, 2007).

In 1994 the Association for Educational Communications and Technology (AECT) published *Instructional Technology: The Definitions and Domains of the Field* in which the authors defined instructional technology as "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (Seels & Richey, 1994, p. 1). Later in 2004, the AECT defined educational technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (AECT, 2004, p.1). Such technologies could include computers, videos, CD-
ROMs, and other types of hardware and software that would facilitate learning (Reiser & Dempsey, 2007) as well as processes and resources.

In 2006, the Technology Integration Matrix (TIM) was created by the Florida Center for Instructional Technology to "illustrate how teachers could use technology to enhance learning for K - 12 students" (p. 1). The matrix is also used as a guide to evaluate technology integration in the classroom. The continuum aligned five interdependent characteristics of meaningful learning environments: active, collaborative, constructive, authentic, goal directed (Jonassen, Howland, Moore, & Marra, 2003) with five levels of technology integration that included entry, adoption, adaptation, infusion, and transformation. Instruction should drive the technological tools being used rather than the technology driving the instruction (Jonassen, 2000). The characteristics of meaningful learning environments describe the activities for which technology was used. The levels of technology integration describe the teacher’s technology literacy. The purpose of TIM aligns with the purpose of NCLB Title II, which “encourages the seamless use of technology in all curriculum areas and promotes technology literacy” (Florida Center for Instructional Technology, 2006, p. 1; No Child Left Behind, 2001).
Table 4

Technology Integration Matrix

<table>
<thead>
<tr>
<th>Level of Technology Integration into the Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entry</strong> The teacher uses technology to deliver curriculum content in a conventional manner.</td>
</tr>
<tr>
<td><strong>Adoption</strong> The teacher directs students in the use of technology tools to create products, for example using a word processor to create a report.</td>
</tr>
<tr>
<td><strong>Adaptation</strong> The teacher encourages students to select and modify technology tools to accomplish specific purposes, for example using computer software to develop a spreadsheet.</td>
</tr>
<tr>
<td><strong>Infusion</strong> The teacher creates a rich learning environment in which technology is integrated throughout the day and across subject areas.</td>
</tr>
<tr>
<td><strong>Transformation</strong> The teacher creates a learning environment in which students are empowered to select appropriate technology tools and actively apply them to the tasks at hand.</td>
</tr>
</tbody>
</table>

**Active**
- Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.
  - **Indicator:** Students use technology for drill and practice and computer-based training.

**Collaborative**
- Students use technology tools to collaborate with others rather than working individually at all times.
  - **Indicator:** Students primarily work alone when using technology.

**Constructive**
- Students use technology tools to build understanding rather than simply receive information.
  - **Indicator:** Technology is used to deliver information to students.

**Characteristics of the Learning Environment**
- **Collaborative:** Students use technology tools to collaborate with others.
- **Constructive:** Students use technology tools to build understanding.

(table continues)
### Technology Integration Matrix

<table>
<thead>
<tr>
<th>Entry</th>
<th>Adoption</th>
<th>Adaptation</th>
<th>Infusion</th>
<th>Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher uses technology to deliver curriculum content to students.</td>
<td>The teacher directs students in the conventional use of tool-based software. If such software is available, this level is the recommended.</td>
<td>The teacher encourages adaptation of tool-based software by allowing students to select a tool and modify its use to accomplish the task at hand.</td>
<td>The teacher creates a learning environment that infuses the power of technology tools throughout the day across subject areas.</td>
<td>The teacher creates a rich learning environment in which students regularly engage in activities that would have been impossible to achieve without technology.</td>
</tr>
</tbody>
</table>

#### Authentic

- **Indicator:** Students use technology tools to solve real-world problems meaningfully to them rather than working on artificial assignments.

#### Goal Directed

- **Indicator:** Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.

(Florida Center for Instructional Technology, 2006)

The matrix was designed to guide teachers and administrators in evaluating the integration of technology into instruction. "Encouraging the seamless use of technology in all curriculum areas and promoting technology literacy are both key NCLB: Title II program purposes" (Florida Center for Instructional Technology, 2006, p. 1). The 25 cell indicators help determine the level of proficiency that teachers integrate technology.
Importance of Instruction Technology

The integration of this array of instructional technology may lead to a variety of benefits for students. Instructional technology has the potential to increase student achievement and prepare them to exit school with the skills that will prepare them to be productive citizens. These skills, known as 21st century competencies, emphasize "what students can do with knowledge, rather than what units of knowledge they have" (Silva, 2009, p. 630). Policymakers, such as governors and school officials, emphasize these competencies so students are prepared to be contributing members of society. School administrators are addressing the need for teachers to teach rigorous, relevant curriculum to the students of the 21st century. Wagner (2008) defines rigor as:

"demonstrated mastery of the core competencies for work, citizenship, and life-long learning. Studying academic content is the means of developing competencies, instead of being the goal, as it has been traditionally. In today's world, it's no longer how much you know that matters; it's what you can do with what you know (p. 111)."

Today's students are referred to as the Net Generation or Millennials. The Net Generation "has been shaped by an environment that is information and communication rich, team-based, achievement-oriented, visually-based, and instantly responsive; they often recoil from isolated, lectured-based, and instantly responsive-deficient silos of learning comprised of outdated technologies from the mid-20th century" (Pletka, 2007, p. 13). Many teachers are teaching to high-stakes tests. When this occurs, real-world experiences, which require students to perform 21st century competencies, are often ignored. Teaching solely by lectures, note-taking, and kill-and-drill practice may not be as effective in contemporary education. Teachers need to vary their instructional methods
to provide opportunities for students to use more technology in order for Millennials to engage in 21st century skills. Wagner (2008) claimed that seven survival skills exist that teens today need. These skills include critical thinking and problem-solving, collaboration across networks and leading by influence, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, accessing and analyzing information, and curiosity and imagination. These 21st century skills all can be enhanced through the integration of technology.

Critical thinking and problem-solving. As contributing members of the 21st century, students will need critical thinking and problem-solving skills. Some characteristics of critical thinking are understanding how the problem has evolved, not accepting things at face value, and being curious (Wagner, 2008). "Problem solving is a popular instructional strategy used in modern technology education classrooms" (Cotton, 2002, p. 29). Critical thinking and problem solving are necessary skills in producing ideas (Okojie, 2011), which are skills that can be used for all grade levels (Cotton, 2002). Many students are Internet surfers who are successful at finding solutions to problems. When something sparks their curiosity, students are prone to investigate further. Selwyn (2009) describes students as "no longer the passive recipient of educational instruction, but instead cast into an active role of (re)constructing the nature, place, pace and timing of learning events as they wish" (p. 4).

A study conducted by Hopson et al. (2001 - 2002) investigated the "effect of a technology-enriched classroom on student development of higher-order thinking skills and student attitudes toward computers" (p. 110). The researchers defined higher-order
thinking skills as "cognitive skills that allow students to function at the analysis, synthesis, and evaluation levels of Bloom's Taxonomy" (Hopson et al., 2001-2002, p. 110). Participants were fifth and sixth grade students in a North Central Texas school district. The treatment group was enrolled in technology-enriched classrooms, whereas the comparison group was instructed in a traditional classroom setting using the prescribed curriculum without technology. Students in the treatment group were given computers and taught how to use Microsoft applications to take notes, produce assignments, and construct projects. The study used a posttest and quasi-experimental design for the treatment and comparison groups.

The findings from the study indicated the treatment group scored significantly higher on subtests measuring computer importance, motivation, and creativity. A difference existed for each level of Bloom's Taxonomy: analysis, synthesis, and evaluation; however, a significantly higher difference was shown for the evaluation level of Bloom's Taxonomy (Hopson et al., 2001-2002). Technology was used as the catalyst in this study to move beyond knowledge acquisition to knowledge application to encourage the development of higher-order thinking skills. The teacher was transformed from lecturer to guide and purveyor of facts to encourager of using the computer as a tool.

Problem solving and inquiry-based learned was also the focus of Zydney and Grincewicz's study (2011). The researchers investigated the "connection between the different perspectives presented through video cases in a technology-based learning environment and the students' ability to ask questions about an authentic socio-scientific
problem” (p. 716). The researchers used a program called *Pollution Solution* to collect data for their study. This program was an “interactive, multimedia learning environment that utilizes video cases, audio, animation, computer tools, text, and graphic elements to create an authentic learning environment to help students develop problem-solving skills and formulate meaningful questions” (Zydney & Grincewicz, 2011, p. 717). The participants included 79 diverse 10th grade students who watched expert videos with differing perspectives on environmental issues. The researchers predicted that the process would promote more student engagement, interaction, and collaboration through simulations, interactive narratives, or immersive games. Throughout the interaction, students would be confronted with “political, ethical, and social implications” (p. 716) that may affect their decisions. The researchers of this study also hypothesized that the inquiry process would be more interactive as students were able to ask live characters or avatars questions. Integrating technology also provided data sources and opportunities for students to collaborate and make connections outside of the classroom.

Quantitative and qualitative analyses were performed in the collection of data. Correlations, a Kruskal-Wallis test, and sequential multiple regressions were conducted to analyze quantitative data, and reflective questions were answered by the students to analyze qualitative data. The researchers found that “many students experienced the authentic nature of the problem through role playing, reacting to characters as if they were real, and expressing an emotional response to the problem” (Zydney & Grincewicz, 2011, p. 726). This is an example of how one teacher provided students the opportunity to learn through technology. The authentic nature of *Pollution Solution* may have increased
students' intrinsic motivation in solving problems and contributed to a sense of empowerment in students' ability to solve problems as measured by the qualitative data that were collected.

Problem solving is a critical skill used in many classrooms. In the qualitative case study conducted by Kim and Hannafin (2011), the researchers "examined how students solve scientific problems in technology-enhanced classrooms and how peer-, teacher-, and technology-enhanced scaffolds influenced student inquiry" (p. 255). The researchers found that technology-enhanced scaffolds, such as intellectual tutoring systems and assistance from teachers, peers, and computer tools to provide cognitive and social supports, are effective when supported by clear goals. Peer scaffolding allowed students to confirm answers, confront conflicts, challenge thinking, and share perspectives. Teacher scaffolding promoted student self-monitoring, revision, and time-on-task. Technology-based scaffolding allowed students to "externalize and visualize their understandings, find and locate resources, save and access notes, and manage cognitive loads" (Kim & Hannafin, 2011, p. 276). Using technology to scaffold instruction had positive effects on students.

Students' critical thinking, problem solving, and higher-order thinking skills can be enhanced in a technology-enriched environment. The teacher can facilitate students' problem solving and decision making skills by allowing them to explore information independently. Integrating technology into instruction for students with disabilities may improve their critical thinking and problem solving skills and assist in reducing the achievement gap. When assistive technology is provided to students with disabilities,
access to the general curriculum may be increased, which could enhance students' critical thinking and problem solving skills.

**Collaboration across networks and leading by influence.** The Net Generation has been "free to choose who they interact with, when and for what purposes" (Selwyn, 2009, p. 4). They are portrayed as "autonomous" and "highly sociable," which has caused some people to describe them as the collaboration generation (Selwyn, 2009). Students today do collaborate globally through online communication networks. The problem is that schools offer few opportunities for students from varying cultures to communicate with one another. This communication could lead to an appreciation of cultures and create global awareness. "Collaboration among employees and workers is a cornerstone to successful industrial and business operations. By encouraging collaboration among teachers and among students, teachers are laying the foundation for team and collaborative work ethics for future workforce" (Okojie, 2011, p. 19).

One particular study examined how games could be used for collaboration. A quasi-experimental design was conducted by Sanchez and Olivares (2011) to determine how a series of learning activities based on Mobile Serious Games (MSGs) affected the development of problem solving and collaboration skills in Chilean eighth grade students. The results of the study showed that 45% of the experimental group thought that science was entertaining and 21% thought it was exciting compared to 38% and 16% from the non-equivalent control group. The students who participated in the MSG-based learning activities valued the out-of-school field trips and the fun experience. MSGs contributed to the development of collaboration skills. The students who participated in the study had a
"better global perception of their collaboration skills than the students in the non-equivalent control group, as well as a better perception of the dimensions related to work responsibility and work objectives" (Sanchez & Olivares, 2011, p. 1950). In this study, games increased students' collaboration skills.

Technology can increase collaboration in the classroom and also globally. At a recent conference, a teacher from the Beaman, Conrad, Liscomb, Union, Whitten (BCLUW) Community School District explained how she contacted a school in Sweden through Twitter, a real-time information network that connects the user to information that interests him or her. After making the connection, her English students collaborated with the students from Sweden through various forms of technology. Later in the year, the school district funded a trip for the teacher and her students to fly to Sweden to meet and visit with the teacher and students they met through Twitter. Students from BCLUW testified that computers opened their eyes to the world around them (high school English teacher and BCLUW students, personal comment, April 11, 2012).

Not only does technology allow students to collaborate globally but also locally. Technology increases peer collaboration when working on shared documents and editing one another's work (Lazonder, 2005). Technology provides a tool for students to collaborate with one another without being in the same room. Collaborative learning for Millennials has become as popular as independent learning was for Boomers (Howe & Strauss, 2000).

The 1996 report written by Bialo and Sivin-Kachala summarized findings from 176 research reviews on technology. The bulk of the report addressed the positive effects
of technology on student achievement. One of the study's findings showed that kindergartners improved conceptual knowledge, reading vocabulary, reading comprehension, and creativity. Another finding showed positive effects on student attitudes and achievement for students with special needs. The study also had positive effects on student attitudes toward learning and on student self-concept. An increased use of online telecommunications for collaboration was integrated across classrooms. Students in the study trained in collaborative learning by using computers. Students had higher achievement, higher self-esteem, and increased attitudes toward learning, especially students with low ability and females (Bialo & Sivin-Kachala, 1996). The results from the study revealed students gained many positive attributes.

Collaboration is a skill that employers seek in potential employees (Jukes et al., 2010 - 2011). Schools must integrate technology so that students with disabilities can learn how to effectively collaborate with their peers in class and globally. Increased collaboration is a benefit in using instructional technology that may decrease the achievement gap and promote inclusive placements for students with disabilities.

**Agility and adaptability.** The technological world is changing at a very rapid pace, and the Millennials seem to be adapting to these changes. Students today are characterized, in general, as being adaptable because of the array of tasks they can juggle at one time. They can easily move from one task to another without hesitation.

The fast pace of today's world causes many opportunities for disruption. Wagner (2008) states that agility and adaptability are necessary skills in dealing with such disruption. The Millennials seem to successfully manage multiple technological
disruptions. Christensen et al. (2008) described disruption as a positive force by which "an innovation transforms a market whose services or products are complicated and expensive into one where simplicity, convenience, accessibility, and affordability characterize the industry" (p. 11). Education would be the "market" and technology would be the "disruption" that this study is investigating. Technology is a disruption for which Millennials have adapted.

The age of technology requires that people have flexibility and autonomous lifelong learning in order to be successful. "Because information and communication technologies (ICTs) are changing and developing so rapidly, mastery of new technologies necessitates a capacity for constant innovation and adaptation" (Warschauer, 2002, p. 457). One example of this is a program called Computers in English Language Teaching (CELT) where Egyptian teachers and learners identified ways in which technology could be integrated into instruction. CELT involved three main parts: pretraining, main training, and follow-up implementation. The pretraining part consisted of CELT members participating in computer-training workshops to plan their technological projects. During the main training part, CELT members participated in an intensive one-month program in the United States to learn about computer-assisted language learning (CALL). The follow-up implementation consisted of CELT members "implementing their projects at schools, continuing discussion over e-mail, participating in advanced workshops in Cairo, and sharing what they had learned with their colleagues by leading their own local workshops" (Warschauer, 2002, p. 462). Because of the high motivation of CELT
members, they sought out new ways to integrate technology in their teaching by being adaptable and innovative.

Technology allows individuals to be adaptable, flexible, innovative, and autonomous. Technologies provide teachers and students to think outside-the-box when delivering instruction or producing a product. This adaptability may increase access to the general education curriculum for students with disabilities and enhance their learning outcomes.

**Initiative, entrepreneurialism, and self-direction.** The Net Generation seems to be entrepreneurial and self-directed. Self-direction is the ability to set goals related to learning, plan for the achievement of those goals, independently manage time and effort, and independently assess the quality of learning and any products that result from the learning experience. Mark Zuckerberg, founder of Facebook at age 19, began this technological phenomenon to allow college students to network socially. This collaborative tool permitted students to collaborate without having to meet at a particular destination. With all the time he spent creating Facebook, his academics started to suffer. He used Facebook as an academic tool to post art pictures that would appear on his art history final. His peers helped him study by posting historical information regarding each piece (Bauerlein, 2008). This is an example of how one tech-savvy individual's academics improved by taking initiative and becoming self-directed.

Millennials are frustrated with the pace of instruction and "teachers who rely on instructional formats suitable for a nondigital society but out of sync with the current environment" (Strom, Strom, Wing, & Beckert, 2010, p. 10). The Center for a Digital
Future at the University of Southern California conducted an annual survey to determine the impact of online technology. Reports from the survey showed that adolescents "consider the Internet to be their most important resource, surpassing all other media including television, radio, newspapers, and books" (Strom et al., 2010, p. 10), spending an average of 15 hours per week online. The researchers developed the Internet Learning Poll for adolescents in which they chose students in eight Title 1 schools in Arizona to participate. The poll consisted of 16 multiple-choice items that allowed students to select more than one option or complete an "other" fill-in-type response. The purpose of administering the poll was to gain "insight about student motivation as reflected by the amount of time spent on the Internet, benefits gained from social networking, and identification of personal learning needs" (Strom et al., 2010, p. 11). Results from the poll indicated that students were motivated to learn in multiple ways and learning from the Internet was the highest. Students preferred the Internet because it allowed them to work at their own pace and discover information which supported feelings of autonomy. Other results revealed that students' understanding of the curriculum increased when they used the Internet for homework and were allowed to share that knowledge with peers. This type of divergent thinking supports creative ideas and recognizes that in some situations "there may be no correct answers, but the ability to see potential options is needed to guide judgment" (Strom et al., 2010, p. 14). Results also showed students need practice processing multiple sources of information available from the Internet rather than reviewing a single textbook. Similarly, students are concerned about the readiness of teachers to design lessons that integrate technology. Millennials want to learn with
technology and believe teachers should spend time preparing more assignments that facilitate more self-directed learning online. Other results from the poll showed students want their schools to be more supportive of Internet learning. Students want courses to be available online to overcome teacher shortage, avoid scheduling conflicts, take classes interesting to them, recapture missed credits, and possibly graduate early. Students also wanted access to computer labs on weekends and evenings to accommodate those families that do not have computer access at home. The final results from the poll agreed that parents should be involved and support Internet learning.

Technology can encourage students to take initiative, be entrepreneurial, and have self-direction. Providing assistive technologies can enable students with disabilities to be more independent learners. Creating the opportunity for students with disabilities to be self-directed learners may help decrease the achievement gap and promote inclusive placements.

Effective oral and written communication. Many students use technology such as blogs, Skype, instant messaging, podcasting, Twitter, and Facebook to communicate and collaborate. Students today consistently communicate through these social networks. They enjoy and thrive on meeting new people through this form of communication. Millennials have become empowered "to communicate understanding in a differentiated manner using varying modes of intelligence" (Randolph, 2009, p. 27). Students are skilled at making connections with people from all over the world. "Employers now seek individuals who know how to read, write, and communicate on the Internet to solve
problems" (Leu et al., 2007, p. 38). Students make global connections by using social media.

The increased use of social media may have impacted Millennials' literacy skills. In their article, Warschauer and Liaw (2011) investigated how emerging technologies could develop language and literacy skills through authentic communication, collaboration, networking, and scaffolding. The authors organized the emerging technologies into four areas: "(1) speaking and listening, (2) collaborative writing, (3) reading and language structure, and (4) online interaction" (Warschauer & Liaw, 2011, p. 107). The specific technologies explained in the article assisted English Language Learners in developing language skills; however, each technology could easily be used for students with disabilities to improve their communication and literacy skills.

Audio podcasts were used to improve individuals' listening and speaking skills. Students could record themselves speak and listen back to determine whether they used correct grammar. Podcasts were also used as a model of authentic listening for students to hear the English language spoken correctly. Blogs, wikis, and collaborative writing tools were used to improve students' written language. Blogs were described as promoting "critical literacy and academic writing" (Warschauer & Liaw, 2011, p. 110) by increasing the amount of words and vocabulary students were using. Wikis were used as a medium for self-directed writing. Some language learners and low-literacy individuals may have difficulties understanding the content on Wikipedia; therefore, a simplified version, Simple English Wikipedia, was created that used more "basic vocabulary and grammatical structures, avoid[ed] idioms and jargon, and [wrote] shorter articles"
Online collaborative writing tools have promoted writing fluency and increased the students' confidence in writing. IBM developed some reading and language programs that provide instant reinforcement to what the student had read or written. Students enjoyed these programs because they were self-paced and differentiated based on the complexity of the vocabulary. Second Life was another means in the study to increase students' oral and written communication. Second Life is an online community that allows people to interact in a digital environment (Warschauer & Liaw, 2011). In Second Life, students can search for information, create and post content, and communicate with others verbally or through text.

Emerging technologies can support language and literacy skills that meet the diverse needs of students, which could promote inclusive placements for students with disabilities. Several examples of technology have been integrated into the curriculum to promote written and oral communication for students with disabilities such as word processing software, word prediction software, and communication technologies (Hasselbring & Glaser, 2000). Landmark College in Putney, Vermont, has provided Dragon NaturallySpeaking to students with learning disabilities who attend the college. Dragon NaturallySpeaking enables students who are unable to write by hand the opportunity to simply speak what they want to write and the program scribes for them. This also helps students who have difficulties expressing themselves in writing. The voice recognition software provides students the opportunities to independently communicate with others (Nuance Communications Inc., 2009). Instructional
technologies can be used as an effective tool to increase the oral and written
communication skills of students with disabilities.

**Accessing and analyzing information.** The Net Generation has the expertise of
locating information within seconds. Selwyn (2009) describes students as having “access
to vast digital networks of information, resources, and people, thus learning in ways that are increasingly ‘situated’ within authentic contexts and webs of knowledge” (p. 5).

Society has evolved from few people having access to information into everyone having the opportunity to access vast amounts of information with the click of a button (Randolph, 2009; Wagner, 2008). Today’s students are skilled at discovering exactly what they are looking for compared to other generations that may take longer pinpointing the same facts. Technology in schools increases the accessibility of information and learning for those who have limited access to technology at home (Christensen & Horn, 2008). Increased accessibility to analyze information may have positive effects on students’ academic achievement.

In a qualitative study conducted by Unal and Inan (2010), accessibility of information was explored. The researchers examined students' perception of a situated learning environment where learning and doing were inseparable. Participants of the study consisted of 25 seventh-grade students. The science teacher created simple experiments and used online resources to enrich traditional lessons. WebQuests were used for students to access information about the water cycle, cloud types and formation, local weather, and climate. The instruction in this situated learning environment was based on modeling, coaching, scaffolding/fading, articulation, reflection, and exploration.
The findings from the study were divided into two sections: students' responses to the science journal questions and observations made by the researcher and teacher. The results showed students had positive perceptions on learning and increased motivation to learn about science.

Using instructional technology to access and analyze information has learning benefits for students with disabilities. Students have more autonomy and motivation to learn the general curriculum content, which may help decrease the achievement gap. Further, using technology to increase access to the general curriculum will increase the opportunities for inclusive placements.

Curiosity and imagination. Growing up in a digital era has caused the Net Generation's imagination and curiosity to be quite different compared to other generations. Technology has allowed these individuals to "take a more active role in learning" and "explore the world and get instantaneous feedback about discoveries" [Department of Defense Education Activity (DODEA), n.d., p.4]. When students are curious about a topic, they go to the Internet until they discover information that satisfies their curiosity. Technology fosters students' creative instincts (Okojie, 2011) by providing access to information interesting to the individual.

Creativity is a "process of having original ideas that have value" (Azzum, 2009, p. 22) and then evaluating those ideas. Teachers can teach creatively or teach for creativity. Teaching creatively means "teachers use their own creative skills to make ideas and content more interesting," whereas teaching for creativity is a pedagogy "designed to encourage other people to think creatively" (Azzum, 2009, p. 26). Technology is
changing the way Millennials work, think, and connect, which allows them the opportunity to be inventive, imaginative, and creative.

Creativity and imagination were the foci in a study conducted by Tingen, Philbeck, and Holcomb (2011). The researchers determined whether classroom websites supported 21st century skills for students. More than 100 classroom websites were screened for this study, and the researchers chose to only analyze 10 with a rubric by two evaluators. Each website was evaluated on core elements that included, but were not limited to "class overview, parents' page, link to homework, links to curriculum, and daily schedule" as well as 21st century skills such as "literacy, information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills" (Tingen et al., 2011, p. 89). The findings from the study revealed websites are not aligning with 21st century goals and objectives. The researchers went further to recommend how teachers could align their websites with 21st century skills that integrated instructional technologies. Tools such as Fizz, iCue, Google Maps, and ToonDoo can support students' creativity and innovation skills in authentic academic experiences.

Scratch is another example of how instructional technology can enhance students' creativity and innovation skills. Scratch is a programming language that allows students to create interactive stories, animations, games, music, and art (Vaidyanathan, 2012). By integrating this technology, Vaidyanathan allowed her students to compete in a global workforce by being educated in science, engineering, technology, and mathematics (STEM) subjects. "Digital design is neither learning about technology nor learning with
technology, but learning creativity and innovation *through* technology" (Vaidyanathan, 2012, p. 25). Instructional technology affords students to compete globally.

Instructional technologies enable students to show their uniqueness through creativity and innovation. These technologies increase opportunities for students with disabilities to learn in different ways, which may help reduce the achievement gap and increase their proficiency. Provided as a supplemental aid for students with disabilities, instructional technologies may promote students' creativity in inclusive settings.

**Student motivation.** Instructional technology may also motivate students to learn. The five-year WEB Project was completed in Vermont's K-12 schools in September 2000. The purpose of the project was to "infuse standards-based instruction in multimedia, digital art, music composition, and online discourse into the general arts and humanities curricula" (Billig et al., 2001, p. 40). The academic content areas consisted of art, music, technology, history/social studies, English/language arts, and interdisciplinary studies. The guiding research question for this project was "What is the impact of the WEB Project on student achievement?" The online survey conducted found a connection between student motivation, metacognition, and learning processes. This outlined the conceptual model developed by Sternberg that stated "motivation drives metacognition, which in turn, stimulates the development of thinking and learning skills" (Billig et al., 2001, p. 40).

The mixed methods used in this study consisted of an online survey, 165 student pretest and posttest surveys, and scores on teacher-created/selected rubrics that assessed students' learning processes and final products. "The hypothesis was that motivation
would drive metacognition, and that metacognition would drive thinking and learning processes (specifically, inquiry learning and application of skills)" (Billig et al., 2001, p. 40). Following this data collection, four path analysis models were tested. Process and product outcomes for class motivation were addressed in the first two and the second two addressed school motivation:

(1) motivation was related to metacognition. The relationship between class motivation and metacognition was slightly stronger. (2) The relationship between metacognition and inquiry learning was stronger than the relationship between metacognition and application of skills. (3) The relationship between inquiry learning and the student learning process outcome was stronger than the relationship between application of skills and the student learning process outcome. (4) The relationship between application of skills and the student product outcome was stronger than the relationship between inquiry learning and the student product outcome (Billig et al., 2001, p. 41).

Correlation does not imply causality in the aforementioned analyses. When each analysis was considered as an independent variable, there was a change in the corresponding dependent variable. There was a "significant correlation between motivation and metacognition, indicating that students' enthusiasm for learning with technology may stimulate students' metacognitive (strategic) thinking processes" (Billig et al., 2001, p. 41). The data found from using the WEB Project suggested that teachers should "emphasize the use of metacognitive skills, application of skills, and inquiry learning as they infuse technology into their respective academic content areas" (Billig et al., 2001, p. 43). Increased student motivation was a perceived benefit when instructional technology was used. Hopson et al., (2001-2002) state that "more positive attitudes toward motivation and creativity indicate that, when provided with technology, students are more likely to take control of their learning, stay focused until the task is complete,
Integration of technology can assist students in metacognition.

The effects of student motivation has been reported in other literature regarding technology integration. A report written by Valdez et al. (1999) investigated the value and use of technology in K-12 education. The researchers had difficulties studying the technological phases because technology changes so rapidly. Three distinct phases were examined: print automation, expansion of learning opportunities, and data-driven virtual learning. During each phase, the researchers addressed the following questions:

(1) What evidence is there that the use of computer-based technology in each phase has a positive effect on learning? (2) What significance do the findings from each phase have for educators today as they try to make technology-related decisions that have an impact on students learning? (Valdez et al., 1999, p. 5).

Phase I relied heavily on drill and practice using the behavior-based branching software to teach content and skills. Phase II used technology as learner-centered tools that allowed students to work together to apply the skills they learned. In Phase III teachers and students had access to data to make decisions that would help in meeting the accountability expectations.

The findings from the report showed that technology offered opportunities for "learner-control, increased motivation, connections to the real world, and data-driven assessments tied to content standards that, when implemented systematically, enhanced student achievement" (Valdez et al., 1999, p. 5). The researchers concluded that technology makes learning more interactive and enjoyable for students, which improves their attitudes towards the subject and learning.
These motivational factors tend to be particularly evident in males. This factor is especially important because of the overrepresentation of males, particularly African American males (Whiting, 2009) in special education. Males outnumber females in special education 2:1. At the secondary level, two-thirds of the students receiving special education services are males (Hasselbring & Glaser, 2000; Wehmeyer & Schwartz, 2001). One of the reasons for this overrepresentation of males is because they are “more likely to have higher activity levels and exhibit behavior that do not conform with classroom regimens” (Wehmeyer & Schwartz, 2001, p. 31). Given the disproportionate number of males in special education, instructional technology may have particular benefits for students with disabilities.

Males tend to gravitate more towards using technology than females. One particular quantitative study by Hwang, Fisher, and Vrongistinos (2009) investigated “the learners’ self-concept of ability, perception of technology, perception of parental beliefs, causal attributions, value factors, and gender issues in using technology” (p. 259). The authors explored the reasons why more males choose scientific and technical careers compared to females. One hundred twenty-nine sixth graders, 65 males and 64 females, were surveyed using a revised survey based on Whang and Hancock (1994) and current motivational theories. One particular factor that contributed to the gender gap in careers in technology was motivation. Individuals who believed technology/computer use was important or easy were more likely to pursue a career in that field. The survey instrument the researchers used in the study had a limited degree of success in measuring students’ motivation as students’ results were inconsistent.
The interaction students are required to display when using instructional technology could accommodate for the high activity levels that males in special education exhibit. Access to instructional technology could change the general culture of the classroom, providing more autonomy and relationship to technology and learning, which could facilitate an increase in academic motivation. This is particularly important as the "use of technology for multimedia projects can be very motivating for students with disabilities" (Hasselbring & Glaser, 2000, p. 118). Integrating technology into the curriculum can motivate students with disabilities to learn the content.

Digital citizenship. Instructional technology facilitates the promotion of social acceptance. Often students with and without disabilities are elbow-to-elbow working together on projects and class assignments. As schools integrate more technology into the curriculum, teachers and administrators need to be aware of and teach students how to be digital citizens. Many schools have character education programs where students learn what is right and wrong morally (Ohler, 2011). Digital citizenship is defined as "the norms of appropriate, responsible behavior" with digital access, commerce, communication, literacy, etiquette, law, rights and responsibilities, health and wellness, and security (Rible, 2012, p. 1). Students need to be taught the expectations of online interactions just as they as taught appropriate face-to-face interactions.

All citizens should have equal digital access regardless of who they are. "Digital exclusion of any kind does not enhance the growth of users in an electronic society" (Rible, 2012, p. 1). Students need to be effective consumers in the new digital economy. Many items can be purchased electronically and as a result, some activities such as
downloading and gambling are being done illegally. A variety of communication options are also available today compared to past centuries. Students have the capability to communicate with anyone, anytime, and anywhere; however, many students have not been taught which digital communication option is most appropriate. Digital literacy is a skill students will need in order to use technology quickly and appropriately. Many jobs require employees to learn processes by searching and reading the information online. Students today need opportunities to practice these skills. Digital etiquette refers to the electronic standards of conduct or procedure that technology users must demonstrate. The digital law is defined as the users’ responsibility for actions and deeds. "Hacking into others' information, downloading illegal music, plagiarizing, creating destructive worms, viruses or creating Trojan Horses, sending spam, or stealing anyone's identity or property is unethical" (Ribble, 2012, p. 1). Digital rights and responsibilities must be understood by all technology users and used in an appropriate manner. Digital health and wellness educates technology users about Internet addiction and the dangers of too much technology. Digital security is the last theme of digital citizenship. Technology users must protect their belongings by having virus protection, backups of data, and surge control of equipment.

Students may communicate with others synchronously or asynchronously. Synchronous discussion is real-time or live communications such as instant messengers, audio chat, or video chat, whereas asynchronous discussion takes place over time such as e-mail, blogs, or wikis (Richards, 2010). When students use technology, they are exposed to many forms of diversity. Teaching students how to be digital citizens promotes
acceptance of diversity. Integrating technology into the curriculum will allow students to acquire the necessary skills to be a digital citizen.

**Summary of importance of instructional technology.** The Net Generation should possess several skills to be informed, responsible citizens of the 21st century. These skills include critical thinking and problem-solving, collaboration across networks and leading by influence, agility and adaptability, initiative and entrepreneurship, effective oral and written communication, accessing and analyzing information, and curiosity and imagination. If these skills are enhanced through the integration of technology, positive effects on students' academic achievement may result.

Society needs “more young people who are problem solvers – who know how to think critically and how to ask good questions – and sometimes even provocative ones. They also need young people who work effectively with others and understand and respect differences – not just in our own country but around the world” (Wagner, 2008, p. 28). A study conducted by Peter Hart Research Associates (2005) showed that educators are dissatisfied with students' writing quality, ability to read and comprehend complex materials, ability to think analytically, work and study habits, ability to do research, and ability to apply what they learn to solve problems. Students must be taught how to think critically and problem-solve, collaborate across networks and lead by influence, be agile and adaptable, take initiative and be entrepreneurial, communicate effectively, access and analyze information, be curious and imaginative, and be diplomatic.

For students with disabilities, learning these 21st century skills will facilitate a successful transition to a post school environment, as required by the IDEA. Integrating
instructional technology throughout the general education curriculum will assist students with disabilities in acquiring these skills in inclusive settings. The integration may also decrease the achievement gap for students with disabilities in and after school. The integration of instructional technology into the school curriculum can facilitate the development of these competencies necessary to be an informed citizen in the 21st century. Yet, the successful integration of instructional technology is limited by several significant barriers.

**Barriers to Using Instructional Technology**

Many advocates of incorporating instructional technology into the classroom state that teaching and learning techniques need to be redesigned to fully utilize the possibilities of digital technology (Johnston & Cooley, 2001; Rados, Rados, & Luburic, 2007). With any possible change, barriers exist. Ertmer (1999) defines first- and second-order barriers to technology integration. First-order barriers are "extrinsic to teachers and include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support" (Ertmer, 1999, p. 48), whereas second-order barriers are "intrinsic to teachers and include beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change" (Ertmer, 1999, p. 48). First-order barriers cause more frustration to teachers because they have little control in obtaining the resources they need. Administrative support can eliminate first-order barriers by allocating money for desired software, hardware, time, and training. Once first-order barriers are eliminated, second-order barriers may surface. Second-order barriers cause more frustrations because they are more personal to teachers.
When schools have a new technology initiative, teachers may feel like first-year teachers because of classroom management, discipline, role definition, and lesson development issues (Ertmer, 1999). Depending on the situation, sometimes first-order barriers may cause more resistance, whereas other times second-order barriers may cause more resistance. This section will describe how resources, institution, subject culture, attitudes and beliefs, knowledge and skills, assessment, and the digital divide pose the greatest barriers for technology integration.

**Resources.** Resources may include technology, access to available technology, time, and technical support (Collins & Halverson, 2009; Hew & Brush, 2007; Reiser & Dempsey, 2007). In order to integrate technology, adequate hardware and software need to be available to teachers. Often, schools purchase hardware without thinking about instructional needs. When teachers decide how they will use the hardware, they may need additional software programs that were not considered while making the initial purchase (Johnston & Cooley, 2001). The increased need for hardware and software programs becomes a financial barrier for many school districts. Finding funding for new computers and appropriate software can be challenging for administrators (Johnston & Cooley, 2001; Reiser & Dempsey, 2007). Schools need to budget or apply for grants in order to secure the necessary funds.

Accessibility to technology is another resource barrier. Computers are usually located in a lab, and teachers need to sign up to use the computer lab. If computers are placed in classrooms, typically only a few are available, which makes it difficult for the teacher to plan meaningful instruction using the computers. In addition to the low number
of available computers, adequate devices such as headphones, digital cameras, projectors, and scanners are usually not purchased for each teacher. Bandwidth becomes another issue when multiple teachers and students are trying to access the Internet. If there is not enough bandwidth, teachers and students are unable to access the desired information from the Internet (Collins & Halverson, 2009; Hew & Brush, 2007; Johnston & Cooley, 2001). Teachers in Selwyn's study (1999) "argued that the inclusion of machines in their own teaching areas would enable and encourage them to use computers in their teaching" (p. 40). Teachers would have the opportunity to plan lessons using technology without worrying about scheduling for the computer lab.

Time is another barrier for proper technology integration. Teachers require additional time to "preview web sites, to locate the photos they required for the multimedia project they assigned to students, or to scan those photos into the computers" (Hew & Brush, 2007, p. 227). Teachers also want to experiment with new technologies so they teach students how to effectively use the technology. Teachers also need time to collaborate with their peers. During this collaboration time, teachers can learn effective ways to plan lessons with technology from colleagues. Additional time may also be spent taking technology courses (Johnston & Cooley, 2001; Reiser & Dempsey, 2009). Hew and Brush (2007) found "teachers who were willing to work longer hours paid a personal price in 'burn out' and an eventual exit from school" (p. 227). By incorporating more time in the day for teachers to play and experiment with new technologies, teacher burn out may decrease and teachers' effective use of technology may increase.
Technical support is another resource barrier. Districts are typically understaffed in technical support, which affects how often teachers integrate technology while teaching. Teachers require technical personnel to assist them in troubleshooting problems, installing software, and answering any technical question. Unfortunately, technical support gets inundated with requests that they often do not respond as quickly as teachers need to get the task completed when desired (Hew & Brush, 2007; El Semary, 2011; Johnston & Cooley, 2001). Providing sufficient support is critical when integrating technology.

The lack of appropriate resources such as technology, access to available technology, time, and technical support pose the greatest barrier to school districts. Computers may not have the proper software and hardware technologies or provide appropriate access for all students and teachers. If technologies are available, minimal time may be allocated for teachers to learn and integrate the tool into their instruction. The importance of technical support is often misunderstood. For technology integration to be successful, technical support needs to be available at all times for students and teachers. Unfortunately, schools' financial limitations are the major reason for the lack of these resources.

Institutional constraints. Barriers associated with the institution consist of leadership, school time-tabling structure, and school planning. School administrators are "expected to serve as technology advocates and instructional leaders who can support teachers as they integrate technology into teaching, learning, and assessment" (Johnston
& Cooley, 2001, p. 59). If administrators were not supportive, teachers' use of technology in the classroom was restricted (Hew & Brush, 2007).

The school time-tabling structure limits the amount of time each teacher has to teach the content. Many schools allow less than one hour for each content area unless the school has blocked scheduling, which allows for more time. If the teacher only has an hour or less, it limits the number of computer-based lessons. The reasoning for this is the amount of time it takes to get students to the lab, logged on to their accounts, started on the task, and time to finish (Hew & Brush, 2007). School planning is the last institution barrier. Schools need to plan out how technology will be used once it is purchased so that it is used effectively. This plan could include professional development opportunities, peer collaboration, ways to utilize technology effectively in the teaching/learning process, and identification of intended outcomes with technology integration.

Leadership is critical to technology integration. A qualitative study investigating leadership as an institutional barrier was conducted by Fox and Henri (2005). The study explored "the use of information technology (IT) in classrooms and teacher readiness to use IT to take up the challenge to use IT as a catalyst for change and reform in education" (p. 161). The participants in the study were all school teachers in Hong Kong who were taking courses to earn the Master of Science in Information Technology in Education. The teachers were interviewed by the authors to determine the concerns teachers had about IT in education. Many questions were asked to understand the teachers' perceptions of their school's development and future planning regarding IT. A typical response was, "It is up to the principal to define the school's vision and mission and to then inform us of
what direction he wants us to go" (Fox & Henri, 2005, p. 164). Teachers called themselves "small potatoes" (p. 164) who thought the leadership role only came from the principal. One of the implications of this study was that there needed to be administrative support to engage in the change process. Clearly, this study found that leadership in the institution may be a barrier that prevents technology from being integrated. Leadership, school time-tabling structure, and school planning may represent barriers to the integration of instructional technology. To effectively integrate technology, schools need to have strong administrative support that strategically plans how technology will be used as well as the amount of time teachers have in which to use the tools.

Subject and school culture. Firestone (2009) describes school culture as a "pattern of shared assumptions that is learned by solving important problems" (p. 671). Three common characteristics of school districts' cultures are:

(1) District culture will concern at least two areas: Teaching and learning - that is, expectations for students and beliefs about what they can learn - and how people will work together; (2) Although cultures are usually defined by shared expectation, the extent of sharing may vary. Especially in schools and districts, cultural themes are unevenly represented; and (3) A district's culture is located at the top, so an ongoing challenge is how to spread constructive cultures to every school (Firestone, 2009, p. 671 - 672).

School and subject culture becomes a barrier because some subjects lend themselves more to computer integration than others. A "culture pressure" exists in schools that appear in the form of "norms, values, and shared beliefs among individuals in work and social contexts" (Ertmer & Ottenbreit-Leftwich, 2010, p. 265). If the majority of the school culture has a negative attitude towards technology integration, the culture pressure
can drive the behaviors and instructional practices of other teachers to change their mindsets or feel uncomfortable in the school culture.

School and subject culture were also examined in a study by Selwyn (1999). He examined school and subject culture as a barrier to the integration of instructional technology. This study on school and subject culture aimed to discover the "extent students' and teachers' use of computers was influenced by their educational context" (p. 32). This study was carried out in the UK education using a track system to determine college readiness. Ninety-six students participated in 19 focus groups and 20 teachers were interviewed individually to determine the influence of subject area use of technology. Data were divided into themes: subject content, pedagogy, assessment, access, and interest.

Through teacher and student interviews, a link between their attitudes toward using technology and the nature and content of the subject area was reported. Tim, a geography teacher, commented,

You know subjects like geography where you've got lots of data that you crunch in and you're producing graphs and you're doing correlations and things like that, then computers are tailor made for that aren't they ... so you use it because it's easy to do (Selwyn, 1999, p. 34).

An art teacher named Katy followed up with this comment:

If you're going to do fine art then there's absolutely no reason to use IT [instructional technology] at all ... You can access art galleries and the like, but then again, from an aesthetic point of view, to me you can't beat standing in front of a picture itself (Selwyn, 1999, p. 34).
These are just a few of the comments made by interviewees in regards to the appropriateness of technology in teaching their subject area. Using technology is dependent on the content for which the teacher will be teaching.

A culture of pedagogy was another theme resonated throughout the data collection. Teachers had different views regarding the appropriate method of delivering the subject knowledge. Katy, the art teacher, followed up her previous comment with:

[When teaching Art] there's that unsaid quality . . . if you're stood in front of a painting or if you're painting yourself - it's a physical process that's not just mechanical . . . I mean you can draw with a mouse . . . but there's almost three disjointed things going on there - your mind and your hand are divorced as it's going through the screen. When you're doing it physically you're more in tune with it (Selwyn, 1999, p. 36).

Some other teachers felt threatened that students would know more about technology, which would pose conflicts to their traditional classroom processes.

Subject cultures are ultimately influenced by the individual who teaches the subject area. If the teacher has an interest in technology, then the likelihood that technology will be integrated in that subject increases, whereas if a teacher does not have an interest in technology, then technology will be used minimally. "The problem remains that people in certain subject areas are more likely to 'get into' IT than in others, thus further exaggerating subject area differences" (Selwyn, 1999, p. 42).

Technology integration into subject areas is socially constructed. In order for technology to be used in a subject area as a learning tool, the significance has to be visible to the teacher (Ertmer & Ottenbreit-Leftwich, 2010). Subject culture can be a barrier to technology integration resulting from teachers' attitudes and beliefs.
Attitudes and beliefs. Teachers' attitudes and beliefs about technology are considered second-order barriers. These barriers may cause more problems because they are less tangible and more personal and deeply ingrained (Ertmer, 1999). Teachers have specific feelings about whether they like or dislike using technology. Teachers' attitudes and how they use technology "fall into one of five general categories of Rogers' innovation model: innovators, early adopters, early majority, late majority, and laggards" (Fabry & Higgs, 1997, p. 389). Innovators try new ideas and are at the forefront of technology. Early adopters are described as those who are successful users of technology and serve as role models to others. Early majority typically wait to see how the technology is used before using it. Late majority wait until they are pressured to use technology or persuaded of its benefits. Laggards are the last to adopt technology. Only 16% of educators fall into the first two categories, innovators and early adopters (Fabry & Higgs, 1997). In their article, Ertmer and Ottenbreit-Leftwich (2010) stated teachers' self-efficacy may be more important than their technological knowledge and skills. Teachers need to "feel confident using that knowledge to facilitate student learning" (Ertmer & Ottenbreit-Leftwich, 2010, p. 261).

Teachers' self-efficacy could be a barrier to technology integration. One study conducted by Ertmer, Addison, Lane, Ross, and Woods (1999) examined the relationship between first and second order barriers by "exploring differences in teachers' uses of technology, their perceptions of the value or role of technology in the classroom, and their beliefs about what constitutes effective classroom practice" (p. 57). The researchers surveyed, interviewed, and observed seven primary teachers' classrooms for six weeks to
determine teachers' and students' technology use. The teachers' teaching experiences ranged from one year to 27 years. Each teacher had a different amount of computer experience and training, which affected their comfort level in using word processing and other software.

The data showed a variation in the amount of technology used, the kinds of use, and the context in which technology was used for the seven teachers in the study. Four of the seven teachers used technology as an incentive for students to finish their work and not as a teaching tool. These teachers described computer use as "an add-on, optional activity, supplemental, and a way to keep kids busy" (Ertmer et al., 1999, p. 62). These teachers saw the importance of using technology, but did not see the relevance of integrating it into their curriculum. Many teachers in the study used technology to support the existing curriculum by reinforcing skills the teachers taught. Six of the seven teachers "indicated that they did not think that their curriculum would or should change because of technology" (Ertmer et al., 1999, p. 63). In their article, Hew and Brush (2007) found that some teachers would only allow computer time when students' work was completed. Some teachers believe technology does not affect student learning and choose not to use it in their instruction.

When the participants from the study were asked reasons for using technology, common responses were that computers were exciting and motivating to students, students need to know how to use computer for the future, lessons were more interesting to the students, teachers could reach students with learning and attention problems, and the teachers enjoyed using technology. Even though teachers saw the relevance of using
technology, their pedagogical beliefs still interfered with technology integration (Ertmer et al., 1999). These beliefs were specific to personal experiences, vicarious experiences, and social-cultural influences (Ertmer, 2005).

Teachers' attitudes and skills can affect how they integrate technology into their instruction. Self-efficacy and first and second-order barriers affect teachers' attitudes and skills in regards to technology. Another barrier to teachers' attitudes and beliefs is their perceived lack of technological knowledge and skills.

Knowledge and skills. The major barrier to technology integration has been the "lack of specific technology knowledge and skills, technology-supported-pedagogical knowledge and skills, and technology-related-classroom management knowledge and skills" (Hew & Brush, 2007, p. 227). Some teachers fear their classroom authority will be lost because computers provide access to more information for students (Collins & Halverson, 2009). Students may not listen to the teacher but rather teach themselves through information obtained from the Internet. Not only do teachers need to learn technology, they need to change how they teach so their classrooms become more student-centered rather than teacher-centered (Ertmer & Ottenbreit-Leftwich, 2010; Fabry & Higgs, 1997). Teachers need to become more knowledgeable about technology integration to increase their comfort level in teaching with technology.

Teachers should be receptive in learning new technologies. Hughes (2005) used a multiple-case research design that explored "how teachers' knowledge is employed and possibly changed within the technology learning activities they experience and the extent to which their subsequent technology-supported practice is innovative" (p. 281).
Replacement, amplification, and transformation are variations of technology-supported pedagogy. Replacement means that technology replaces the traditional method used; however, the instructional goals are not changed. Amplification focuses on completing the same tasks more efficiently and effectively by using technology to get the task accomplished. Transformation uses technology to change students' content, cognitive processes, and problem solving or teachers' instructional methods and roles in the classroom (Hughes, 2005).

Four practicing teachers were interviewed in Hughes' (2005) study. Each interview focused on how the teacher acquired knowledge about educational technology, how the teacher used technology in the classroom, and the interaction between professional knowledge, technology learning, and practice. Through the case study analysis, four themes emerged:

1. informal learning experiences facilitated these teachers' access to and use of technology;
2. content-focused learning experiences yielded content-based technology integration in the classroom;
3. learning experiences that focused on teaching technology within general educative examples demonstrated technology's general educative value that, in turn, inspired teachers to explore the possibilities for the technology in their own classrooms; and
4. all participants had learning experiences that focused solely on technology with no connections to education or their content areas (Hughes, 2005, pgs. 295 - 297).

Implications from Hughes' study showed that professional knowledge can impact teachers' engagement and integration of technology in the classroom. Teachers also have to be taught how to embed technology into curricular learning opportunities.

Collaborating with teachers who teach the same content is also critical. Teachers can share how they use technology-supported pedagogy (Hughes, 2005).
Teachers' knowledge and skills are vital to technology integration. Not only do teachers need the knowledge of the technology, they also need to know how to prepare their students to be technologically capable. Teachers' lack of knowledge and skills could result as a barrier to technology integration.

The standards-based movement. With NCLB's increased emphasis on student proficiency, the emphasis on high-stakes testing also increases. The pressures of these tests can be a major barrier to technology integration. Some teachers feel they can cover the content faster through lectures rather than finding technological software that matches the lesson objectives (Hew & Brush, 2007). Because of this, the focus of using technology in schools has changed from teaching and learning to a way of facilitating assessment. Drill and kill software can fit into this way of teaching, however, but not "adventurous uses of computers, such as to carry out in-depth research or complete meaningful projects" (Collins & Halverson, 2009, p. 42). Collins and Halverson (2009) claim the standards-based movement caused by NCLB is working against the kind of learning that computers facilitate. The standards-based movement has increased the use of high-stakes testing using objective methods restricting the opportunities for students to show they have learned the concept.

Selwyn's study (1999) found "there was a sense that these teachers felt their overriding function was to guide the students through the final process of passing the examination" (p. 37). Because of these feelings, teachers inevitably left technology out of their teaching practices. "Only a small minority of educators holds the belief education
should be about students constructing their own understanding using computer tools" (Collins & Halverson, 2009, p. 43).

Teachers' perceived emphasis on the requirements of the standards-based movement has become a barrier to technology integration. Students and teachers need more opportunities to explore how technology can increase student achievement rather than just teaching the content through lecture. Without this exploration, the standards-based movement may continue to limit the integration of instructional technology.

**Digital divide.** Generational factors may also constitute a barrier to the successful integration of instructional technology. While students have been immersed in a technology-rich environment, teachers and administrators may be new to the digital culture. Individuals born during the Net Generation are sometimes referred to as Digital Natives (Considine et al., 2009). Marc Prensky coined the term Digital Native, which describes young people born between 1984 - 2001 or after the introduction to digital technology. Digital Natives have been immersed and constantly surrounded by technology since birth (Considine et al., 2009; Prensky, 2001a). They have acquired their own "digital language" through the countless hours spent on the computer, playing video games, and using the Internet (Berk, 2008). Shah and Sunil (2009) defined Digital Natives as, "Youths significantly affected by the rise of Internet technologies; an emerging global population growing up with digital technologies central to everyday functioning" (p. 1). According to Berk and Trieber (2009), Digital Natives have nine distinct characteristics:

8.5 multiple intelligences, 3 to 7 learning styles, technology savvy and expect it, intuitive visual communicators (image not text-oriented), craves interaction with
people and tools, prefers to work in teams, learns through discovery, responds quickly and expects rapid responses, and shifts attention rapidly and multi-tasks (p. 33 – 35).

Many Digital Natives spend 6.5 to 11 hours per day multi-tasking through media stimulations such as listening to music, playing computer or video games, talking on cell phones, sending e-mails or text messages, and watching movies or television (Berk, 2008). Linda Stone (2007), a former software executive from Microsoft, differentiated multi-tasking and continuous partial attention. Stone stated that one multi-tasks when he/she does many things at once to be more productive and efficient, whereas continuous partial attention is when one only pays partial attention continuously. Digital Natives are motivated to be connected to a live node on the network so they do not miss out on anything; therefore, they display continuous partial attention (Stone, 2007).

*Digital Natives’ thinking patterns.* Digital Natives’ brains have physically changed as well as their thinking patterns (Healy, 1990). Because Digital Natives have been exposed to various modes of technology all their lives, these “inputs” have physically changed their brains as compared to previous generations’ brains. Repeated experiences with technological devices have caused the Digital Natives’ brains to become larger and more developed in cognitive areas such as visual-spatial skills, inductive discovery, mental maps, and respondent time contributing to the physical change of their brains (Prensky, 2001b). Neuroplasticity describes how the brain *constantly* changes throughout our child and adult lives based on the stimulation it receives from the outside (Healy, 1990). Eighty-seven percent of children age eight to 17 play video games for several hours on a daily basis (Walsh et al., 2005). This constant interaction with fast-
paced, interactive games have altered or shaped the Digital Natives’ brains to think differently than previous generations.

**Digital Natives’ culture and environment.** The environment and culture surrounding Digital Natives as well as their experiences with technology have affected Digital Natives’ thinking patterns and thought processes. Environmental and cultural pressures such as socio-economic status, gender, and geography may also influence people’s digital technology use. Scholars Vandewater et al. (2007) found that technology use is lowest for rural youth, female youth, and youth whose parents have low levels of education. Conversely, youth living in higher social classes and urban areas may have a technological advantage because they have more access to technology and technological resources.

**Digital Immigrants.** Marc Prensky (2001a) defined Digital Immigrants as “people who were not born into the digital world but have, at some later point in their lives, become fascinated by and adopted many or most aspects of the new technology” (p. 1–2). They were born before the rapid infusion of digital technology (Considine et al., 2009). If Digital Immigrants have embraced technology, how is it they fail to understand Digital Natives? Just because Digital Immigrants use technology for personal reasons does not mean they use it as an educational tool. For example, many Digital Immigrants use Skype to communicate with friends and family. Digital Immigrant educators could use Skype as a collaborative, educational tool in the classroom to communicate with authors or increase global awareness. Sandy Cutshall (2009) has seen how Skype, blogs, and wikis have “fostered bilingual conversations and dissolved cultural barriers” (p. 41).
Cutshall also said, "Such moments of human contact make geography, culture, and language real for students" (p. 41).

Often Digital Immigrants accuse Digital Natives of not paying attention or choosing not to pay attention to the instruction presented to them. Prensky (2001a) stated, "Often from the Natives' point of view their Digital Immigrant educators make their education not worth paying attention to compared to everything else Digital Natives experience – and then Digital Immigrants blame Digital Natives for not paying attention" (p. 3). Much of the literature portrays Digital Natives as uninterested in traditional classrooms because the information is presented in slow, step-by-step, sequential order. Digital Natives do not have patience for this kind of instruction. Digital Natives are used to receiving and gathering multiple forms of visual information rapidly (Prensky, 2001a). Digital Immigrant educators may not fully grasp how technologically literate Digital Natives can be.

Another cause for this generational divide is that Digital Immigrants do not know the "digital language." This creates a communication barrier between Digital Immigrants and Digital Natives. When Digital Immigrants refer to a record player or a dial, Digital Natives do not understand this language or what these terms mean. Many Digital Immigrants socialize in person, through postal mail, or over landline. These are outdated means of socializing for a Digital Native. Digital Immigrants, compared to Digital Natives, go to the Internet as a second source for information instead of the first source (Prensky, 2001a). Digital Immigrants rely on books and scholarly articles, whereas
Digital Natives “surf the web” until they locate what they were hunting for without questioning the credibility of the source.

*Digital Immigrants’ teaching practices.* Digital Immigrants were taught using Socrates’ method of learning: asking questions and testing answers in a debate format. Tony Wagner (2008) says, “The most important skill in the New World of work, learning, and citizenship today is the ability to ask the right questions” (p. 111). Wagner suggested that most Digital Immigrants have this skill, but Digital Natives lack the ability to ask the right questions to lead them to plausible answers. Digital Immigrants were taught the traditional curriculum that included reading, writing, arithmetic, logical thinking, and understanding the writings and ideas of the past compared to how Digital Natives want to learn, digitally and technologically (Prensky, 2001a).

Digital Immigrant educators like things sequential because that is how their brains are “wired”, but Digital Natives’ brains are not “wired” the same way. Prensky (2001a) suggests that Digital Immigrants like traditional teaching methods such as lecture, rote memorization, and kill-and-drill practice, whereas Digital Natives require faster paced, interactive, authentic learning opportunities. Instead of constant slow-paced instruction, Digital Natives want to learn how to think critically through authentic learning (Wagner, 2008).

Not all Digital Immigrant educators require students to memorize facts, but one may think that unless Digital Immigrant educators change how they teach, Digital Natives will continue to be unmotivated to learn 21st century competencies needed to
become active citizens. Educators need to understand how children learn in order to create powerful technology-based learning environments.

Much of the traditional student learning was rote memory at the surface and scholastic levels, in which children memorized predetermined facts disseminated by their teachers in contrived contexts within the classroom. However, our growing understanding of cognitive science is teaching us the limitations of these traditional approaches. To function successfully in the 21st century, today's children need opportunities to learn at deeper levels. They need to be actively engaged in their learning through interactions with teachers and other students (Johnston & Cooley, 2001, p. 2).

Digital Natives are accustomed to technology as a means of communication. To keep Digital Natives engaged, Digital Immigrant educators need to consider Digital Native's multiple intelligences and learning styles as well as their desire to interact through technology. What does this digital difference mean in regards to how students today think and process information?

The perceived digital divide has become a potential barrier to technology integration. Digital Natives and Immigrants think, interact, and talk differently. This difference has a profound effect on the teaching and learning process. In order for Digital Immigrants to teach Digital Natives, Digital Immigrants have to better understand the digital world in which they live.

Summary of barriers. Even though NCLB and IDEA emphasize an increased use of technology for instruction, several barriers limit or prevent teachers from fully integrating technology. Resources, institutional constraints, subject culture, attitudes and beliefs, knowledge and skills, the standards-based movement, and the digital divide pose significant barriers for technology integration. If these barriers can be addressed, the integration of technology can be enhanced. This integration can positively affect the
achievement of students with disabilities and the inclusion of placements. Strategies that teachers and schools can implement to overcome the barriers include developing a shared vision and plan, overcoming the scarcity of resources, changing attitudes and beliefs, reconsidering assessment, and conducting professional development.

**Strategies to Overcome Barriers**

Strategies schools can consider to overcome the barriers of integrating technology are numerous. By incorporating these strategies, schools may decrease the achievement gap and promote inclusive placements for students with disabilities.

**Shared vision and technology integration plan.** Administrators and teachers need to have a shared vision in how technology will be used in the school district. This vision should have a starting point, goals to achieve, and guides along the way. This vision will keep school personnel focused on enhancing student learning through technology integration (Hew & Brush, 2007). Creating a vision will also allow teachers to model technology use, reflect on and discuss ideas, and collaborate with others. Modeling could be reading/viewing case studies or demonstrations done by peers who integrate technology while teaching content (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010).

Teacher reflection is vital to change. "Reflection is facilitated by providing continual time for teachers to interact with knowledgeable others and to share developing ideas via professional development activities" (Ertmer, 1999, p. 55). Collaboration is the last way to ensure the vision occurs. Teachers have access to a supportive network of peers that have conversations and shared experiences with successful technology integration (Ertmer, 1999).
Schools should also have a technology integration plan that focuses on teaching and learning, not just acquiring technology. This could begin by developing a technology committee comprised of administrators, teachers, and outside facilitators who are willing to research and facilitate change in the school (Hew & Brush, 2007). A needs assessment could be done to determine how technology is currently being used as well as what could be done to enhance learning with technology (Fabry & Higgs, 1997). The integration plan could increase teacher training in curricular areas to support technology integration at the instructional level (Ertmer, 1999). The shared vision and plan comes from having a strong leader. Schmoker (2006) stated, "When leadership is focused on results, on urging a formal, frequent review of the impact of instruction, teaching improves" (p. 126). To be proactive, school districts must establish a shared vision and develop a technology integration plan to prevent any barriers from affecting the integration of technology.

**Overcoming the scarcity of resources.** The quantity of technology, access to technology, time, and technical support are resource barriers. Hew and Brush (2007) stated three options to overcome the scarcity of technology: create a hybrid technology setup that is more cost effective for the district, introduce technology to one or two subjects at a time to ensure adequate technology use by teachers and students, and use laptops rather than building expensive computer labs. "With the emerging wireless technologies, some schools are finding that providing students with laptops on carts is a productive way to meet the student technology needs" (Johnston & Cooley, 2001, p. 63).

To overcome the lack of access to technology, Hew and Brush (2007) suggested placing computers in the classroom rather than in centralized locations. When teachers
have access to computers in their classrooms, they are more likely to use them for instruction. Teachers can also group students and rotate them between computer time, small group activities, and seatwork. "Greater access can be achieved through fundraisers, donations, and grants, as well as through the formation of partnerships with businesses, universities, libraries, and community and vocational colleges" (Ertmer, 1999, p. 56).

Time is a persistent problem in education. Teachers need time to adequately learn and plan (Johnston & Cooley, 2001). The lack of time can be overcome by extending the class time. Having block schedules or doubling class time will allow teachers more time to incorporate technology into their lessons. Teachers' class loads could also be reduced to allow more time for them to familiarize themselves with technology. More time would also allow teachers to collaborate with one another to create technology-integrated lessons (Ertmer, 1999; Hew & Brush, 2007).

To integrate technology into the classroom, teachers need professional, technical, and instructional support (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010; Johnston & Cooley, 2001). Students could be taught how to solve technical problems so teachers could focus on instructional activities (Hew & Brush, 2007). Johnston and Cooley (2007) suggested districts share technical support through consortia arrangements. Logistical issues would need to be established so teachers could receive the assistance they need in a timely manner. Once teachers feel comfortable with troubleshooting the technical issues, they may require more instructional and professional support to enhance their technology integration (Ertmer, 1999).
Overcoming the scarcity of resources requires school districts to increase the accessibility of technology, time, and technical support. This may require schools to purchase more technology, allow more time to teach each subject, and hire more technical support.

**Changing attitudes and beliefs.** In order to change teachers' attitudes and beliefs, Hew and Brush (2007) stated school districts need to consider four factors. Schools must have a vision and plan in place regarding how technology will be used. Resources and professional development must also be available for teachers. Administrators should also provide encouragement to teachers when integrating technology. When teachers have support from colleagues and administrators, their attitudes and beliefs about using technology may change. This could be done by establishing professional learning communities that align with the goals and vision of the district (Ertmer, 2005).

Teachers should be exposed to technology to better understand how it can be integrated. One participant in Ertmer et al.'s study (1999) did have changing views on technology. During her first interview, the teacher described only using the computer for supplemental purposes. In her second interview, she "described the role of technology as that of supporting and strengthening the curriculum" (Ertmer et al., 1999, p. 64). When she did integrate technology into a math lesson, she was surprised at the success. "Not only was she able to introduce new concepts through the use of technology, but the lesson also prompted her students to work collaboratively to solve problems" (Ertmer et al., 1999, p. 64). This made her reconsider her beliefs about including technology into her curriculum.
Teachers' experiences with how technology can be integrated into the curriculum to increase student achievement are vital. Once teachers have this experience, their previous negative beliefs about technology integration may change. Overcoming the barrier of teachers' negative attitudes and beliefs requires schools to have a vision and plan, resources and professional development, and support from administrators and colleagues.

Reconsidering the standards-based movement. One of the barriers to integrate technology was how the teachers felt pressured to cover enough content so students would pass the high-stakes assessment. When technology is integrated into the curriculum, assessment needs to be reconsidered because of how closely curriculum and assessment are intertwined (Hew & Brush, 2007). School districts will need to think of alternative ways to assess to meet the demands of standards-based accountability when using technology to deliver instruction.

Dexter and Anderson (2002) followed eleven schools that implemented a school-wide improvement plan that was supported by educational technology. The schools had to implement reformed pedagogy that included inquiry or project based learning. "The implementation of the innovation and the educational technology required teachers to adopt new roles, as well as revise instruction and assessment practices and curriculum with state standards and achievement tests in mind" (Dexter & Anderson, 2002, p. 3). The learning environments in the schools focused on four critical elements: learner centered, knowledge centered, assessment centered, and community centered. The learner centered environment focused on professional development opportunities that build upon
the teachers' strengths, interests, experiences, choices, and time to collaborate.

Components of a knowledge centered environment focused on understanding instructional issues and how teachers learn, having a vision, and supportive leadership style. The assessment centered learning environment provided opportunities to try new approaches in real settings and receive feedback. In order to facilitate this, schools should have "policies that orient assessment to goals of enhanced learning, not just external accountability" (Dexter & Anderson, 2002, p. 5). The community centered environment focused on trust, sharing, and collaboration that encouraged a professional community. The schools in these cases followed the aforementioned learning environment designs and had success. Teachers were pleased that students could work independently, which led to an increase in student motivation toward learning. Students also made gains on state examinations, which reflect that technology-supported project-based learning might have played a key role in improved student outcomes (Dexter & Anderson, 2002).

Schools need to consider alternative ways to assess students rather than the objective standards-based high-stakes assessment that NCLB requires. A reformed pedagogy calls for schools to implement inquiry or project-based learning using technology to assess students. By reconsidering the way schools assess students, teachers may feel less pressure to teach to the test (Guilfoyle, 2006) and integrate technology more willingly.

Conducting professional development. Conducting professional development is the most important strategy to overcome first and second-order barriers. In order for teachers to effectively use technology for instruction, they need to be taught how and
when to use it (Fabry & Higgs, 1997). Technology training can address both pedagogical and technological needs for teachers, which could influence previous attitudes and beliefs as well as their knowledge and skill set (Ertmer, 1999; Hew & Brush, 2007). Professional development should

(a) focus on content (e.g., technology knowledge and skills, technology-supported pedagogy knowledge and skills, and technology-related classroom management knowledge and skills); (b) give teachers opportunities for 'hands-on' work; and (c) is highly consistent with teachers' needs (Hew & Brush, 2007, p. 238).

Teachers need to learn how to integrate technology into their classrooms for instructional purposes rather than for technical reasons. Because technology integration is new for some teachers, it may have an effect on how they manage their classrooms. Teachers should be taught how to effectively set up their classrooms to maximize teaching and learning with technology. Professional development that promotes active learning is one strategy teachers can become more knowledgeable about technology. Johnston and Cooley (2001) stated teachers need to use technology by developing constructivist approaches. "Professional development based on constructivist teaching methods provides opportunities for teachers to explore, reflect, collaborate with peers, and engage in hands-on, authentic learning tasks" (p. 72).

Professional development should be included in the school's action plan. El Semary (2011) suggested the following:

schedule a number of long term workshops to enhance faculty's skills in using classroom technology; develop strategies for making time for professional development activities related to technology use; consider mentorship as an effective tool to overcome barriers to technology use; emphasize the new roles of faculty as a coach or facilitator; focus on building a knowledge base about teaching and learning with technology to ensure that technology planning, decision making, and professional development are based on research; ensure that
educational goals for technology are aligned with student learning goals; clearly specify the intended outcomes of the technology professional development; and recognize teacher successes with technology (p. 30 - 31).

These provisions are just a few to consider in making professional development relevant for teachers' integration of technology.

Integrating technology into the curriculum, ideally, begins at the university level when teachers are going through their teacher education programs. Throughout their college experience, they should be given opportunities to learn and teach with technology. If pre-service educators observe technology integration by a supervising teacher or college professor, pre-service educators may be more apt to use technology in their own teaching (Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010). This early exposure to technology will improve teachers' attitudes, beliefs, knowledge, and skills about integrating technology into the curriculum.

Regardless of when teachers are exposed to technology, continued professional development is essential. As teachers' technological needs change so will their need for professional development. The provisions of NCLB ensure that teachers will integrate technology into the curriculum for the purposes of improving student achievement. In order to reach this successfully, ongoing professional development is a must.

Summary of strategies. With the increased emphasis of integrating technology into the curriculum from NCLB and IDEA, schools are searching for technological tools that work for teachers and students. In order to comply with NCLB and IDEA, schools must integrate instructional technology to address the achievement gap for students with disabilities and promote inclusive placements. Ertmer and Ottenbreit-Leftwich (2010)
stated "It is time to shift our mindsets away from the notion that technology provides a supplemental teaching tool and assume, as with other professions, that technology is essential to successful performance outcomes" (p. 256). While barriers to successful integration exist, several strategies may be employed to reduce those challenges. If administrators focused professional development more on technology knowledge and skills, technology-supported pedagogy, and technology-related classroom management, then technology integration may be enhanced. By decreasing the barriers, students with disabilities will have increased access to the general education curriculum and to an array of technologies designed to increase student achievement. Two recent applications of instructional technology that have been effective for students are gaming and one-to-one laptops. Much of the literature on these two technological tools has shown that students are motivated to use them to learn the content presented by the teacher. Both teachers and students have their own perspectives on how these untraditional technological tools can enhance learning, decrease the achievement gap, and facilitate inclusive placements for students with disabilities.

Gaming

Gaming is defined as playing a type of serious game with a purpose more meaningful than just entertainment. Gaming is versatile and is supported by the constructivist theory (Deubel, 2006). Epistemic games create situations that are rigorous for students to play. Students are able to act as professionals and learn how to innovatively think. Gaming teaches people about a certain subject, historical event or culture, as well as assisting them in learning a skill through simulations (Gee, 2008). In
his book, *Good Video Games + Good Learning*, James Paul Gee stated that video games “organize learning in deep and effective ways” (p. 28), empower learners, provide learners an identity, allow learners to manipulate and distribute knowledge, solve problems, and give meaning to experiences. Gaming allows students an opportunity to fail, and in return experiment with ideas, strategies, and approaches to assist them in overcoming their failure (Debolt, 2010). Simulations provide an authentic experience in a visual and auditory world where the player can manipulate virtual characters (Gee, 2008). The simulations of these video games allow people to be and experience more than what they ever thought they could; this, Gee says, is good and healthy for the soul. Games such as *Digital Zoo, Escher's World, The Pandora Project, science.net, Urban Science, The Sims*, and *RollerCoaster Tycoon* encourage innovative thinking and problem solving (Shaffer, 2006). Gaming has positive effects on learning and student motivation. These games are perceived by teachers and students as positive learning supports. Gaming may also assist in increasing peer acceptance for student with disabilities, an important goal of inclusion.

**Effects on learning.** Adults should monitor children to prevent them from playing inappropriate video games and to enhance the learning opportunity. Din and Calao (2001) conducted a study to determine if “kindergarten students who played Sony PlayStation (Lightspan) educational video games learned better than peers who did not play such games” (p. 95). Forty-seven kindergarteners, ages five to six, were a part of this study: 24 students in the experimental group and 23 in the control group. Students in the experimental group were given Lightspan activities with a partner to play during a 40-
minute session at school five days a week. The experimental group was also expected to play a minimum of 30 minutes every evening with their parents. This experiment lasted for 11 weeks.

Besides the 40-minute session the experimental group devoted to playing video games, the rest of their school day was spent with the rest of the class receiving instruction from the teacher. The results showed that even though both groups increased their scores on the posttest in spelling and reading, the experimental group made significantly larger gains; however, there was not a significant difference in the math portion of the posttest between the two groups.

The significant gain the experimental group demonstrated in spelling and reading decoding skills compared to the control group were attributed to the collaborative efforts displayed by the pair of students (Din & Calao, 2001). The study conducted by Educational Development Center and SRI International found that interactive games can have a positive effect on preschoolers' literacy. When video games were incorporated into the curriculum, preschoolers made significant gains in letter naming, letter sounds, story and print concepts, and knowledge of letters in name (Nagel, 2009).

Besides incorporating video games into the curriculum, they can also be used as a supplement. A study conducted by Chuang and Chen (2009) investigated whether "computer-based video games facilitate children's cognitive learning achievement" (p. 1). The authors found that "playing computer-based video games was determined to be more effective in facilitating third-graders' average learning outcome than text-based
computer-assisted instruction” (Chuang & Chen, 2009, p. 4). The supplemental use of the video games to reinforce the content has had an effect on students’ learning.

Not only do video games have a strong impact on elementary students’ learning, they also contribute to middle school, high school, and college students’ learning. A study conducted by Annetta, Cheng, and Holmes (2010) examined the impact of a Multiplayer Educational Gaming Application (MEGA) for high school biology students. In this study, the authors assessed the students’ 21st century skills of “inventive thinking, high productivity, and effective communication” (Annetta et al., 2010, p. 1). The benefits of instructional technology include students' increased abilities to think critically and problem solve, collaborate across networks and lead by influence, become agile and adaptable, take initiative and be entrepreneurial, communicate effectively, access and analyze information, become curious and imaginative, become motivated to learn, and become digital citizens. Wagner (2008), author of The Global Achievement Gap, refers to these benefits as survival skills teens need to have today. These skills are also what employers are looking for in new hires. Annetta et al.'s study found that students engaged in playing the MEGA exhibited these 21st century skills.

Schacter (1999) analyzed five of the largest scale studies on educational technology to determine their impact on student achievement. These five studies aggregated the results of over 700 individual, empirical research studies involving educational technologies. The results showed students with access to

(a) computer assisted instruction, or (b) integrated learning systems technology, or (c) simulations and software that teaches higher order thinking, or (d) collaborative networked technologies, or (e) design and programming
technologies, show positive gains in achievement on researcher constructed tests, standardized tests, and national tests (Schacter, 1999, p. 9).

The results of this study confirm that educational technology can positively affect students' learning and achievement.

Gaming could be a collaborative instructional technology used to decrease student dropout and disengagement. Research has found that "authentic activities that extend beyond the classroom into communities of practice can enhance student participation and promote a sense of belonging and engagement" (Pletka, 2007, p. 21). Video games such as Digital Zoo, Escher's World, The Debating Game, and The Pandora Project allow players to think and solve problems like professionals in virtual worlds (Shaffer, 2006). Gaming may increase the learning engagement of students with disabilities, resulting in higher achievement.

Gaming also allows players to interact with other players through affinity spaces. Students who may not participate in class discussion build their confidence by being proficient game players. Other "gamers" rely on one another to provide advice, tips, or just chat about the game. This opportunity builds confidence for "so-called 'at-risk' learners, students who have come to school under-prepared, who have fallen behind, or who have little support for school-based literacy and language skills outside of school" (Gee, 2008, p. 30). With this increased confidence, students who play video games are inclined to increase their participation in the classroom (Shaffer, 2006). Gaming may be a supplemental learning aid capable of increasing classroom participation for students with disabilities in inclusive settings.
Effects on motivation to learn. Many people may believe that video games are more motivating to boys than girls. However, Papastergiou (2009), found “boys and girls exhibit similar achievement” (p. 9) when using computer games. Despite this conclusion, boys compared to girls in the sample “exhibited significantly greater involvement with, liking of and experience in computer gaming outside school as well as significantly greater initial knowledge of the embedded subject matter, and greater interaction among them during the intervention” (p. 10). Likewise, Bourgonjon, Vlacke, Soetaert, and Schellens (2010) found “no direct relationship between gender and preference for video games. Instead, they appear to be mediated by ease of use and experience” (p. 1152). Different games appeal to boys and girls based on the difficulty level of the game and the individual's experiences.

Students today are engrossed with technology and being a part of a social network. Often schools do not infuse as much technology into the curriculum as students desire. Students seem to be unmotivated to be at school and learn. A study conducted by Rosas et al. (2003) “evaluated the effects of the introduction of educational video-games into the classroom, on learning, motivation, and classroom dynamics” (p. 1). The research found that “children were highly motivated to play with video games even at the end of the implementation period” (Rosas et al., 2003, p. 84). Many children preferred video games over homework, sports, drawing, running, playing ball, and playing with friends. Teachers in the study used video games as a motivational tool for students who displayed inappropriate behaviors.
Gaming provides players a challenge they are not accustomed to in school. The difficulty level of video games can be tailored to the individual needs, which can be the hook for many players. Students approach a task in pursuit of a specific goal, a response described as motivational engagement. Many video game players exhibit motivational engagement when they are playing games (Hoffman & Nadelson, 2010). Studies on video games showed that students' literacy skills, learning, achievement, and motivation all increased when video games were used.

**Teacher and student perspectives.** Both teachers and students report that gaming has positive effects on learning. Ray and Coulter’s study (2010) focused on how 18 pre-service teachers perceived games to contribute to academic learning. Pre-service educators completed a 5-point scale as a pretest and posttest. Statements on the test were organized into three categories: learning/learning theory, instructional practice, and motivation.

The results of the study showed that “89% of respondents agreed that digital mini-games have the potential to support meaningful learning, only 75% agreed that digital mini-games could be integrated into their own teaching methodologies” (Ray & Coulter, 2010, p. 97). Some discussion to this contradiction was the lack of pre-service educators’ knowledge of linking games to learning outcomes as well as teachers giving up control over their classroom.

Once these 18 pre-service educators were exposed to how digital mini-games could be incorporated into the classroom for instruction, their attitudes and perceptions changed from the pretest. Pre-service educators were given the opportunity to experience
how playing mini-games could motivate students to learn concepts taught in school subjects. The results of this study revealed pre-service teachers’ perceptions of how video games could increase learning increased once they participated in the games and saw how they could be used for educational purposes (Ray & Coulter, 2010).

Students, on the other hand, crave technology in school. Many students comment they have to “power down” when they get to school because of the slow paced instruction. Bourgonjon et al. (2010) empirically tested 858 secondary students about their perceptions of video games in the classroom. The results showed that many students prefer playing video games in school that are useful and easy-to-use. Students also “identify learning opportunities as an important third user belief to use video games in the classroom” (Bourgonjon et al., 2010, p. 1151). Like teachers, students also see the importance of video games being tied to the curriculum.

Gaming not only attracts elementary and high school students, but also adults. A study conducted by Hoffman and Nadelson (2010) tried to uncover what factors influence video game players in their decision to play, the nature of their play, and their persistence in playing video games. One-hundred eighty-nine undergraduate and master level education majors volunteered to be participants in the study. Through interviews, the authors made three conclusions: “engagement in video gaming satisfied socialization needs; the perceptions of control and challenge were associated with engagement; and the cognitive and affective outcomes of gaming typically resulted in feelings of satisfaction, accomplishment, and contentment” (Hoffman & Nadelson, 2010, p. 266). As a result, players seem to have higher self-confidence, which can be attributed to successful game
playing. Students reported a preference for learning supported by gaming. Teachers familiar with how gaming can be used to support learning also reported positive perceptions. Gaming may also play an important role in promoting peer acceptance, an important goal for students with disabilities.

**Effects on peer acceptance.** The social aspect of schools can be very difficult for some children especially those with challenges. Gaming can bridge the gap between students who are socially withdrawn and those who are not. A study by Tan and Cheung (2008) tested whether computer group work could improve peer acceptance for a boy with attention deficit hyperactivity disorder (ADHD). Sociometric ratings were administered to the boy's peers before and after the implementation of cooperative video games. The researchers also interviewed the boy's parents and teachers before and after the intervention. Tan and Cheung found that video games did benefit this boy's acceptable social and cooperative behavior and skills. Not only was he able to choose other peers with whom to work, but he was also being chosen by his peers for activities (Tan & Cheung, 2008).

Besides students with ADHD, students with autism also have difficulties interacting appropriately with their peers. Piper, O'Brien, Morris, and Winograd (2006) designed a case study of SIDES: Shared Interfaces to Develop Effective Social Skills. This cooperative video game was designed for social group therapy for individuals who have "difficulties reading facial expressions, interpreting body language, and understanding social protocols" (Piper et al., 2006, p. 1). The authors found that students with autism showed an increase in positive language as well as a decrease in the amount
of aggressive behaviors. The students seemed to have more positive conversational exchanges as well.

Since inclusive classrooms are becoming more prevalent, school leaders will need a tool to establish a safe, accepting environment for all students. Gaming provides opportunities for students with disabilities to work collaboratively with their peers to build positive relationships. Gaming also provides access to the general education curriculum. The simulations and higher-order thinking skills required of video games may contribute to increased academic performance for students with disabilities.

**Gaming and the achievement gap.** Integrating gaming into instruction has the potential to decrease the achievement gap and increase students' 21st century skills. Students' motivation and learning increased when video games were used. A public school in New York City, Quest to Learn, has taken Gee's advice and developed a program that incorporates video games as part of their classes. The teachers at Quest to Learn say it's "integral to 21st century literacy. Students learn how to solve problems, how to communicate, how to use data, how to begin to predict things that might be coming down the line" (Chaplin, 2010, p.1). Students at Quest to Learn take the same standardized tests that all public schools take, and the school has seen "significant improvement" (Chaplin, 2010, p. 2) in the students' scores.

The Clark County School District in Las Vegas, Nevada, had been working on a five-year pilot program that brought ST Math software to seven of the lowest-performing elementary schools. "ST Math teaches abstract math concepts through video game-like instruction. The game was geared toward elementary students and remedial middle
school students who guide a virtual penguin named JiJi through a series of increasingly more difficult levels and learn math concepts as they play along" (Takahashi, 2012, p. 2). Students playing ST Math must master the math concept before moving up to the next level. Preliminary results showed that ST Math contributed to gains in student achievement. At one elementary school, the percentage of third and fourth graders proficient in math as measured by standardized tests, increased eight percentage points between the first and second year of ST Math implementation. Another elementary school, which had a 60 percent poverty rate, increased 14 percentage points on average test scores.

Students who played ST Math developed critical thinking skills to mastery each math concept. Teachers were also able to "create an individualized curriculum for each student, tailoring homework and practice problems to a particular student's weaknesses" (Takahaski, 2012, p. 3). Currently, 20 percent of instruction is done through ST Math. The district is hopeful that students will continue to show achievement gains.

Gaming provides students authentic opportunities to visually manipulate virtual worlds. The use of gaming may be a possible solution in addressing the achievement gap for students with disabilities. The use of gaming in inclusive environments not only will impact student learning and achievement but will also build acceptance between students with and without disabilities. Gaming is one plausible technological application schools could use in inclusive classrooms to decrease the achievement gap.
One-to-One Computing

Besides gaming, one-to-one computing could be integrated in inclusive classrooms to decrease the achievement gap between students with disabilities and their nondisabled peers. The proposed research focuses on this specific instructional technology, one-to-one laptops.

One-to-one laptops are becoming increasingly prevalent in schools today. In 1989, Methodist Ladies College in Melbourne, Australia, required all students grades 5 through 12 to have a laptop, becoming the first of many schools to study how laptops affect the teaching learning process (Stager, 1998). One-to-one laptop initiatives started appearing in the U.S. in the mid-1990s (Penuel, 2006). Currently, many school leaders are searching for ways to motivate students and increase achievement and are hoping laptops may assist.

The goals of one-to-one computing. The goals of implementing one-to-one computing vary from school to school. Common goals include improving academic achievement, increasing equity of access to digital resources, increasing economic competitiveness by preparing students for today's workplaces, and transforming the quality of instruction (Apple Computer, Inc., 2005).

Effects on achievement with one-to-one computing. People implement one-to-one computing with the hope it will positively affect student achievement and provide greater access to technology. In a review of literature, Holcomb (2009) stated that 1:1 initiatives have the potential to significantly affect education in numerous educational settings. Students who have participated in laptop programs have scored significantly higher than
students in non-laptop programs in "writing, English-language arts, mathematics, and overall grade point average" (Holcomb, 2009, p. 50). Warschauer, Arada, and Zheng (2010) found that laptops had the greatest impact on student writing. Students "conduct more background research for their writing; they write, revise, and publish more; they get more feedback on their writing; they write in a wider variety of genres and formats; and they produce higher quality writing" (p. 221). Students who use laptops write more than students in traditional classrooms because it's easier and they receive more feedback (Warschauer, 2005/2006). If laptops are not accompanied by the appropriate pedagogy, they may become a distraction rather than a benefit (Karsenti & Collin, 2011; Warschauer et al., 2010). Littleton Public Schools' writing program exposed students to a variety of genres, modeled writing each genre, and provided opportunities for students to share their writing through blogs, wikis, and chat tools. Through this collaboration and communication, students were motivated to write for an authentic outside audience (Warschauer et al., 2010).

A specific study conducted by Lowther et al. (2003) examined how teachers integrate one-to-one computing into their instruction. Lowther et al. conducted a mixed method study consisting of 12 laptop classes and nine control classes. Of the 21 classes in the study, six were in fifth grade, nine in sixth grade, and six in seventh grade for a total of 391 students and 21 teachers. The purposes of the study were to determine if teaching and student behavior were different when using a laptop compared to traditional instruction without the use of a laptop and if students achieved differently in laptop classrooms. This study was based on the constructivist theory that "encourages student
uses of the computer-as-a-tool for active inquiry and problem solving" (p. 24). Only teachers who taught a laptop class received "NTEQ training which provided fairly extensive professional development not only on technology integration but also on associated student-centered teaching methods" (p. 26). Many instruments for collected data were used such as School Observation Measure (SOM), Survey of Computer Use (SCU), writing assessment, problem-solving assessment, student survey, student focus group, teacher interview, and district parent survey.

The results from the SOM showed laptop classes used direct instruction, teacher acting as coach or facilitator, independent seatwork, and technology as a learning tool as the primary instructional strategies. The control classes used more traditional, teacher-centered strategies such as direct instruction, higher-level questioning, and independent seatwork. The summary of the SOM revealed "academically focused class time was rated as high in 72% of the laptop visits, while level of student interest or engagement was rated as high in 62%. In the control classes by comparison, these ratings were 70% and 44%, respectively" (Lowther et al., 2003, p. 32).

The SCU was designed to capture student access to, ability with, and use of computers rather than teacher use of technology. Four types of data were recorded: computer capacity and currency, which means the age and type of computers available; configuration, which refers to the number of students working at each computer; student computer ability, which records the number of students who are computer literate; and student activities, which consists of production tools, Internet and research tools, and
educational software. The results from the SCU showed the computer literacy skills of the laptop students were rated significantly higher than control students.

The writing assessment examined four dimensions of writing that included ideas and content, organization, style, and conventions. The researchers performed MANOVA, which indicated the laptop group having a medium to highly significant program effect on all four writing dimensions. Effect sizes were computed using Cohen's $d$ formula and ranged from +0.53 to +1.47, which represent strong and educationally important influences. Conventions of writing was the writing dimension that had an effect size of +0.53, whereas the other writing dimensions had higher effect sizes of +1.43, +1.47, and +1.10. The problem-solving assessment consisted of seven components:

understands problem, identifies what is known about the problem, identifies what needs to be known to solve the problem, determines how the data need to be manipulated to solve the problem, describes use of technology, describes how to present findings, and collaborative learning (Lowther et al., 2003, p. 30).

The means of the laptop and control groups showed a highly significant difference for laptop students on five of the seven problem solving components, which were understands problem, identifies what is known about the problem, identifies what needs to be known to solve the problem, determines how the data need to be manipulated to solve the problem, and describes use of technology.

Student surveys were given to both the laptop and control groups. The laptop group stated their computer skills had increased and wanted to continue using laptops. When asked about the best part of the laptop program, the majority of the laptop group "indicated that the laptop made schoolwork easier, faster, and more varied due to the use of the Internet and CD-ROM resources" (Lowther et al., 2003, p. 36). When asked about
the hardest part the laptop program, almost half the laptop group responded that the
"laptop computer was heavy and difficult to carry" (p. 36). The control students were also
interviewed in this study. These students were "acquiring regular computer experiences
but in ways less diversified in scope and less connected to everyday classroom instruction
than did laptop students" (p. 39). Their perceived computer skill levels using more
sophisticated tool software was less than the laptop group.

During the student focus groups, the laptop group indicated "the laptop had
influenced classroom-level changes in fostering more project work, research, higher-level
thinking, writing, and cooperative learning" (p. 39). Laptop students also responded
positively when asked how laptops influenced their personal learning. The control student
group had mixed responses to many questions. "In general, control students were positive
about classroom computers but did not see the technology as substantively changing
teaching and learning activities" (p. 39).

Teacher interviews were also reported. The most effective aspect of the program
identified by the laptop teachers was "the improved ability of students to use the
computer and to conduct Internet-based research," whereas difficult aspects included
"monitoring use of the Internet and technical difficulties" (p. 39). Laptop teachers
observed students more willing to complete project-based activities and worked more
cooperatively with peers. During interviews with the control teachers, they indicated "a
desire for more computers to decrease the student-to-computer ratio" (p. 40). They also
experienced difficulty of student unfamiliarity with computer use which caused some
demands on classroom management.
Sixty-six parents of the laptop group responded to a formative evaluation. One-third of the parents indicated the best aspect of the program was their child's increased level of computer skills, whereas the worst aspect of the program was the difficulty children had carrying the laptop home with all their other books, instruments, and other supplies.

In summary, Lowther et al. (2003) found that laptop classes used more student-centered teaching strategies such as project-based learning, independent inquiry, teacher as coach, and cooperative learning, which caused for a busier and more active learning environment. The results also showed laptop students had an increasingly higher confidence using basic software than the control group.

Lowther et al.’s (2003) study showed the “application of technology in K-12 classrooms will be increasingly judged on the basis of demonstrating success in raising student achievement” (p.43). For this particular study, the laptop group did outperform the control group in the writing and problem-solving assessments. These data do support the notion that one-to-one laptops could be used as an alternative methodology to decrease the achievement gap between students with special needs and their peers.

Student achievement was also evident in Gulek and Demirtas’s (2005) study. The purpose of Gulek and Demirtas’s (2005) quantitative study was to examine the effect of participation in a laptop immersion program on student achievement. This study took place among sixth, seventh, and eighth graders in one California middle school in 2001 and all students were eligible to participate. Parents purchased laptops used by their student and if families could not afford a laptop, resources were provided to participating
families. Researchers in this study collected the following data: "students' overall cumulative grade point averages (GAPs), end-of-course grades, district writing assessment scores, California Standardized Testing and Reporting (STAR) Program Norm-referenced test scores, and Criterion-referenced test scores from the STAR California Standards Tests" (Gulek & Demirtas, 2005, p. 11). The data were compared between students using laptops and students who did not use laptops.

Baseline data indicated that students who participated in the laptop immersion program and those who did not had similar academic achievement. The conclusion of this study found that students who participated in the laptop immersion program earned "significantly higher test scores and grades for writing, English-language arts, mathematics, and overall Grade Point Averages (GPAs)" (Gulek & Demirtas, 2005, p. 29) than non-laptop students. Results from the study also showed laptop students were more engaged, reflective, and active in their learning than non-laptop students. The longitudinal findings provided evidence that participation in the laptop immersion program did have a significant impact on student achievement. "To increase the achievement of all students, findings from this study suggest that all students must have equal access to technology rich environments in which technology is no longer a shared commodity" (Gulek & Demirtas, 2005, p. 30). Increased student achievement has been the results from many laptop studies. Specifically, students' conceptual knowledge, reading vocabulary, reading comprehension, writing, and creativity increased. Students' attitudes and achievement for students with special needs positively changed as well as their ability to collaborate across classrooms. Positive effects on student attitudes toward
learning and on student self-concept were evident especially for students with low ability and females.

**Access to technology.** One-to-one laptops allow students and teachers to have access to the most current information within seconds. This new technology enables teachers and students to move beyond the basics of using computers to having universal access, anytime and anywhere (Karsenti & Collin, 2011). Regular access to the internet "allowed more 'just -in-time' learning" (Warschauer, 2008, p. 61), which means that students are able to locate information at the point of need rather than later when they have access to the Internet.

In the early 2000s Maine's governor had a $70 million budget surplus. With this extra money, the governor wanted to furnish every seventh and eighth grader in Maine's 239 middle schools with a laptop; this affected 37,000 students. Many people were skeptical that the laptops were going to make a difference; however, students' attitudes toward school became increasingly positive. The Maine Learning Technology Initiative (MLTI) focused on four critical factors to make it successful: access to technology, focus on learning, emphasis on leadership, and context-embedded professional development (Muir, Manchester, & Moulton, 2005).

This new access to technology had a profound impact on Maine's middle school students. One student who seldom turned in work and was academically disengaged became an active, motivated student who regularly submitted work after receiving his laptop. Another student at Maine middle school was a student with a disability who never participated in class. After receiving a laptop, the student produced "an incredible iMovie
telling the story of a bomber run in World War II" (Muir et al., 2005, p. 2). These are just a couple of examples of how providing access to technology increased students' motivation to learn and participation in the classroom. In order for the laptop initiative to really be successful, students must have access to technology all the time including at school and home. Some schools do not allow laptops to go home with students, which still widens the equity gap between the privileged students who have computers at home and the not-so-privileged students who don't have access to computers at home (Muir et al., 2005).

Another focus in the MLTI was on learning. Teachers implemented four instructional practices to enhance student learning, which consisted of assessment for learning, place-based learning, project-based learning, and online research. Assessment for learning helped all students answer the question: "What do I have to do to help every student get it?" (Muir et al., 2005, p. 3). Place-based learning allowed students the opportunity to connect with their communities in engaging and meaningful ways. Project-based learning provides student choice based on their multiple intelligences and learning styles. The choice allowed students to synthesize and apply their learning to real-world situations. Online research provided students with online databases to access research that supports topics in which students are learning.

The MLTI also emphasized the importance of the teacher as the leader. In order to improve teaching through technology integration, classroom teachers needed to be involved. Maine formed the Design Team for Curriculum and Professional Development, which was made up of classroom teachers, technology coordinators, administrators,
higher education faculty, and education consultants. This group created a network of
highly-skilled educators who participated in all-day meetings so they could learn about
school change when using technology.

The last emphasis of the MLTI was on context-embedded professional
development. Many teachers had prior knowledge in using laptops as educational tools.
"As a result, practicing educators and teacher candidates need extensive training in
effectively integrating technology into classroom instruction" (Muir et al., 2005, p. 5).
Professional development began at the introductory level and provided supports such as
an online helpdesk, conferences, online tutorials, teacher-created materials, and
curriculum resources and links. The MLTI knew that in order for students to have success
with laptops, teachers must be educated on how to use laptops as instructional tools. The
positive effects this study found that impacted teachers and students were that teachers
were more effectively helping students achieve state standards, students were more
motivated to learn and acquired 21st century skills, and the acquisition of knowledge
positively changed (O'Hanlon, 2007).

In a 2006 research synthesis, Penuel found three common characteristics for one-to-one computing in the classroom:

(1) providing students with use of portable laptop computers loaded with
contemporary productivity software (e.g., word processing tools, spreadsheet
tools, etc.); (2) enabling students to access the Internet through schools' wireless
networks; and (3) a focus on using laptops to help complete academic tasks such
as homework assignments, tests, and presentations (p. 331).

Many initiatives focused on student-centered, differentiated lessons that require higher-
order thinking skills. The degree of technology integration was influenced by the
teachers' beliefs about students, the role of technology in learning, and the availability of high-quality digital content (Penuel, 2006). When teachers did use laptops, students reported using computers for word processing, Internet research, presentations, skills practice, spreadsheets, and multimedia and design.

Teachers should know how to provide students' opportunities to access relevant information to support their learning. In the study conducted by Dunleavy et al. (2007), the researchers observed how one teacher used laptops so students could access more information. An eighth grade language arts class needed to answer biographical questions concerning the author, J. R.R. Tolkien, by searching the Internet for information. The teacher modeled how to access information from different search engines and demonstrated how to bookmark particular websites that students found interesting. The teacher provided a structured opportunity for students to work independently to retrieve facts that were most interesting to him/her. The 1:1 learning environment provided increased access and organization for students to complete the assigned task.

Having access to the Internet and technology, encourages the development of 21st century skills. Students are able to readily access and analyze information within seconds. The increased accessibility to information has many benefits alone but could certainly affect the achievement gap and promote inclusive placements for students with disabilities.

*Increase economic competitiveness.* One-to-one computing has the potential to increase students' 21st century skills which in turn would provide employment opportunities. Research showed that many 1:1 initiatives have resulted in students'
acquisition of 21st century skills (Corn et al., 2010; O'Hanlon, 2007). Specifically, Maine and North Carolina's laptop initiative revealed students' 21st century skills improved. With the acquisition and increased development of 21st century skills, schools have learned many lessons that may influence future 1:1 initiatives. One critical lesson learned was the understanding of "how essential 21st century skills such as life and career skills, learning and innovation skills, and information, media, and technology skills are for today's high school graduates" (Corn et al., 2010, p. 3). Acquiring these important skills may increase employment opportunities for Millennials.

In 2006, Pennsylvania's governor, Edward G. Rendell, announced that 100 schools were going to participate in the state's Classroom for the Future initiative. The initiative was to reform high schools by providing various forms of technology such as one-to-one laptops, SMART boards and video cameras. Gerald Zahorchak, Pennsylvania's Secretary of Education, stated the initiative would "provide students with 21st century skills and excite them about learning" (Miners, 2007, p. 13). Students involved in this initiative were enthusiastic, engaged, and attended school. They saw the relevance in the content they were learning through project-based learning. Administrators had expectations that all students involved in the initiative would acquire 21st century skills, which included "fundamental literacy skills, problem-solving skills, and skills to work together as teammates" (Miners, 2007, p. 13). Laptops have become the vehicle by which students demonstrate 21st century competencies. Acquiring these vital skills may decrease the achievement gap between students with and without
disabilities. Students with disabilities may also be better prepared to transition from high school to a career by demonstrating 21st century skills.

*Transforming the quality of instruction.* Technology-rich learning environments require a changing role of the teacher. The goal and purpose of what teachers do, "to help students learn the relevant skills, knowledge, attitudes, attributes, and behaviors that they'll need to be good and productive citizens, parents, and workers," (Jukes et al., 2010-2011, p. 16), has remained the same. The process in how teachers achieve this goal has changed. Stager (1998) suggested that with one-to-one computing “authentic opportunities to learn with/from students” as well as “new scheduling, curriculum and assessment structures emerge” (p. 2). Teachers have transitioned to the role of a coach/facilitator where they have become empowered to improve their teaching and instructional practices (Holcomb, 2009).

Transforming the quality of instruction requires teachers to wear many different hats and assume a variety of roles and responsibilities in technology-based learning environments. Teachers are viewed as "instructional method specialists, team players, technology integration specialists, instructional technology researchers, change agents, mentors, lifelong learners and specialists in setting the stage for learning" (Okojie, 2011, p. 17).

As instructional method specialists, teachers adjust their teaching to differentiate, problem- or project-based teaching approaches that demanded higher-order thinking skills to meet the varying learning styles of each student (Beck-Hill & Rosen, 2012; Jukes et al., 2010 - 2011; McGhee & Kozma, 2003; Okojie, 2011; Penuel, 2006). In the
technology integration specialist role, teachers used theoretical knowledge to determine which technological tool would be most appropriate for instructional use to enhance teaching and learning (Okojie, 2011). Teachers needed to be advocates in acquiring current technologies: "It's about having a digital network culture where using digital tools is the new reality of both business and personal life" (Jukes et al., 2010 - 2011, p. 18). As an instructional technology researcher, teachers use technology to facilitate instruction, by researching technological changes and evaluating those changes to determine if they are appropriate for instructional tasks (Okojie, 2011). Teachers became role models by demonstrating what lifelong learners do. Lifelong learners make teaching stronger and keep the information relevant and up-to-date (Jukes et al., 2010 - 2011; Okojie, 2011).

Teachers also become change agents in technology-rich classrooms. Often teachers introduced "students to societal problems through service learning and they can challenge students to address those issues using problem-solving approach" (Okojie, 2011, p. 21). By exploring these issues, students were required to use higher-order thinking skills to solve the problem. The problem was linked to the world outside school to ensure the task produced engagement and relevance (Jukes et al., 2010 - 2011). The last changed role of teachers was to set the stage for learning. This refers to "teachers' understanding of the demands of instruction and his/her ability to reconcile those demands with the students' needs" (Okojie, 2011, p. 23). Most importantly, the teacher becomes the facilitator of knowledge rather than the director or classroom manager that typifies traditional classrooms.
Laptop and technology-rich classrooms have caused the teacher's role to change. Teachers' roles and responsibilities are now that of instructional method specialists, team players, technology integration specialists, instructional technology researchers, change agents, mentors, lifelong learners and specialists in setting the stage for learning. With these new teacher roles and responsibilities, the quality of learning has transformed to enhance student achievement.

Another important aspect of the transformation for the quality of instruction involves the students' role. Not only have teachers' roles and responsibilities changed in technology-rich classrooms, but students' roles have also changed. Stager (1998) identified the following student outcomes when using 1:1 laptops:

- students take enormous pride in their work; individual and group creativity flourishes; multiple intelligences and ways of knowing are in ample evidence; connections between subject areas become routine; learning is more social; work is more authentic, personal and often transcends the assignment; social interactions tend to be more work-related; students become more naturally collaborative and less competitive; students develop complex cooperative learning strategies; kids gain benefit from learning alongside teachers; and learning does not end when the bell rings or even when the assignment is due (p.2).

Technology allows these outcomes to be accomplished whenever and wherever it's convenient or practical to the student (Jukes et al., 2010 - 2011). Learning does not need to be confined to the brick and mortar school building in which many people are accustomed.

New student roles consist of being a self-learner, team member, and knowledge manager (McGhee & Kozma, 2003). Students as self-learners allow themselves to determine the content of the curriculum by identifying real-world projects in which students are interested. Classrooms become student-centered rather than teacher-centered.
Another role for students is that of a collaborator or team member. When students work on projects, it is typically done in teams. Students’ role as a team member is to advance the project, share responsibilities, and collaborate in order to finish the task. Often this kind of learning is based on discovery where students will search the Internet for ideas and find primary sources to support their project or task (Jukes et al., 2010 - 2011). The last new role of students is that of knowledge manager. The "focus of the role is on the development of knowledge products such as reports, research studies, newspapers, or multimedia presentations that solve a real world problem, address a scientific question, or express personal feeling" (McGhee & Kozma, 2003, p. 4 - 5). For each of these roles, education will focus on two sets of multimedia information processing skills. The first set of skills requires students to receive and decode messages sent from a variety of media. "The second set of skills involves the communication of messages by the student using various multimedia formats" (Jukes et al., 2010 - 2011, p. 18).

Laptop and technology-rich classrooms have made the student a more active participant in the classroom. Students have taken more ownership of their learning by changing their roles to that of self-learners, team members, and knowledge managers. Teachers’ and students’ roles are required to transform when one-to-one computing is integrated into the curriculum. The transformation to integrate technology also causes some significant barriers.

**Barriers to transformation.** Many barriers to integrate technology into instructional practices exist. Barriers are also specific to implementing one-to-one computing. Some perceive laptops could be a distraction in the classroom (Keengwe et
al., 2011). In addition, Schoepp (2005) added the following barriers to effectively implement 1:1 laptops: “poor administrative support; negative staff attitudes and lack of knowledge towards computers; problems with time, access, space, supervision, and operations; poor software; curriculum integration difficulties; and lack of technical support” (as cited in Keengwe et al., 2011, p. 138 - 139). Overcoming the barriers could make the transition to one-to-one integration go more smoothly.

**Classroom management.** One-to-one computing requires teachers to manage their classrooms differently. In their study Dunleavy et al. (2007) found that students sometimes used their computers as an opportunity to disrupt class by turning up the volume while watching videos, going to a different webpage, and chatting online. One-to-one computing raises classroom management to another level especially if the teacher does not have strong classroom management skills in a traditional classroom. The researchers also found that the students sometimes forgot to bring their machines to class, did not have their machines because of repair issues, and arrived to class without a fully charged battery (Dunleavy et al., 2007). These unforeseen issues caused the teacher to have to think on their feet to adapt the lesson for the students who did not have a laptop. The lack of strategically placed outlets throughout the classroom also caused problems when students needed to charge their laptop and an outlet was not close to their desks.

**Administrative support.** School administrators have to be supportive when implementing laptops. Administrators who are not supportive of laptop implementation can have detrimental effects to the program's success. An evaluation report regarding North Carolina's 1:1 initiative focused on principal leadership as a critical component to
the implementation. Principals in the study were evaluated using Anderson and Dexter's (2000) taxonomy of educational technology leadership decisions that included "strategic planning, goal setting, vision and vision sharing; budgeting and spending; organizational structure and processes; curriculum; program evaluation and impact assessment; and external relations and ethical issues" (Corn, 2010, p. 6). Findings discovered the principal's role changed in 1:1 schools. Principals' 21st century skills increased as well as their willingness to learn new skills. Just as students became more self-directed when using technology, principals, too, were visionaries who needed to learn more about 1:1 to assist their teachers. Principals also needed to support differentiated professional development to build the varied skill levels of teachers. The last finding showed principals involved other faculty in shared decision making.

Lessons learned for supportive administration was a policy guide would be in place and buy-in from the community established. Principals should also receive 1:1 training alongside teachers so they are cognizant of the information teachers are learning.

Administrative support can be a barrier to successful transformation to 1:1 programs. By conducting research, continually learning, being a visionary, and sharing decision making, administrators can have success in implementing 1:1 laptops. One-to-one computing requires many additional resources such as time, space, supervision, hardware/software, technical support, and money (Karsenti & Collin, 2011; Keengwe et al., 2011). Administrators need to be cognizant of these required resources and provide teachers time to explore the available options laptops offer to support instruction.
Professional development. Professional development is a critical component for effective teaching, especially when there are new educational initiatives such as 1:1 laptops. Teachers have to have the time to discuss the pedagogical and educational values, ideas, and resources (Digital Education Revolution NSW, 2010).

Teachers who reported spending nine hours or more in educational technology professional development activities were more likely than teachers who spent less time in such activities reported feeling well- or very well-prepared to use computers and the Internet for instruction (Penuel, 2006, p. 333).

In their 2001 study, Franklin, Turner, Kariuki, and Duran identified vision, access, time, assessment, and professional development as the most common barriers when using technology. Districts spend six to 15% of their technology budgets on professional development that focuses on basic operations rather than curriculum integration. The researchers investigated "one-to-one mentoring as a strategy for helping in-service teachers learn to use technology in teaching and learning" (Franklin et al., 2001, p. 27). Each mentor was required to meet with his or her teacher for 45 minutes for 21 weeks to develop strategies for overcoming the barriers of vision, time, access, and assessment. Mentors assisted teachers in providing technical support and troubleshooting problems. In the end, mentors indicated that teachers were excited as they learned new tasks. Having mentors assisted teachers in acquiring the skills and computer knowledge needed to integrate technology into their instruction.

Professional development is a potential barrier to transformation. In order for 1:1 programs to be successfully implemented, teachers need to be taught how to integrate technology into their instruction.
The barriers to one-to-one computing align with the barriers to instructional technology, which were previously described. One barrier to integrate instructional technology was institutional constraints, which aligned with the administrative support barrier described to integrate one-to-one computing. Another barrier to integrate instructional technology was the lack of resources such as technology, access to available technology, time, and technical support. Such barriers as well as a lack of professional development opportunities are associated with the integration of one-to-one computing.

All four goals of one-to-one instruction, achievement, equal access, employment, and transformation of learning, will be particularly beneficial for students with disabilities. If barriers to integrate one-to-one computing are overcome so that these goals are achieved, many benefits will be realized.

**Benefits to one-to-one computing.** The benefits of implementing one-to-one computing are numerous. Specific benefits include the ability to formatively assess learning, individualize instruction through self-guided pacing, student motivation, increased student interaction and collaboration, and communication and materials management.

*Ability to formatively assess learning.* One-to-one computing allows for a more assessment-centered classroom. In the final report of the Laptops for Learning Task Force completed in Florida, the evaluators stated 1:1 computers could "greatly enhance a teacher's ability to make authentic assessment part of day-to-day instruction" (Barrios et al., 2004, p. 13). Teachers have the ability to provide continuous feedback, which results in more meaningful assessment. Students, in turn, have the ability to evaluate their
performance and set learning goals. One-to-one computing promotes teachers' and students' abilities to effectively measure 21st century skills.

One-to-one computing provides students and teachers opportunities to formatively assess acquired knowledge. In a study conducted by Dunleavy et al. (2007), the researchers discovered what added value one-to-one laptops bring to teaching and learning. The purpose of this qualitative, case study design was to "understand how middle school teachers used laptops at a 1:1 student to laptop ratio in the context of curriculum and instruction" (Dunleavy et al., 2007, p. 442). Two middle schools that consisted of sixth, seventh, and eighth graders were purposefully selected for the study. Eight teachers within the two school districts were also purposefully selected based on "peer and administrative recognition and students who consistently perform well on state standardized achievement tests" (Dunleavy et al., 2007, p. 443). The researchers collected data through formal and informal interviews, direct observations and site documents. Interviews were conducted with all the eight teachers, a sample of students, technology coordinator and resource/media specialist, and the principal from each site.

The researchers found that teachers commonly used 1:1 laptops for online research and productivity tools, drill and practice, and eCommunications through video, audio, and data in online environments. Drill and practice exercises provided added value in students' ability to formatively assess their progress and provide timely feedback. This increased independence freed up the teacher from having to answer every question as well as decreased the amount of student wait time. Teachers were also able to monitor students' progress more closely through the automated grading and reporting features and
make instructional decisions based on each student’s results. The computer applications used in this study had many scaffolding and coaching features that had the potential to shift teachers' “current understanding of drill and practice from a low-level didactic learning approach to a high-level constructivist approach” (Dunleavy et al., 2007, p. 449).

The increased independence that one-to-one computing provides students to formatively assess their progress also effects the acquisition of their 21st century competencies. Students who formatively assess their progress build their skills in taking initiative and thinking critically about the content they are learning.

*Ability to individualize instruction through self-guided pacing.* One-to-one computing also provides teachers the ability to individualize instruction for diverse learners. An ongoing study conducted by Karsenti and Collin (2011) investigated the benefits and challenges of using laptops in primary and secondary schools. Participants in the study included 2,432 students grades 3 through 11, 272 teachers, 14 education support staff and three school principals. Data were collected through survey questionnaires, individual semi-directed interviews, and group interviews. Although the findings were preliminary, the researchers identified that one-to-one laptops assisted teachers in creating individualized, differentiated learning opportunities for a variety of learners.

The study conducted by Dunleavy et al. (2007) also found that 1:1 laptops increased individualized instruction and provided self-paced instruction. These two characteristics empowered teachers to create more learner-centered classrooms. Through selected computer applications, each student had "the ability to proceed through a series
of learning tasks at her or her own pace in an engaging, but challenging laptop or web-based program" (Dunleavy et al., 2007, p. 450).

Creating a learner-centered environment through individualized instruction has the potential to reduce the achievement gap and promote inclusive placements for students with disabilities. The self-guided pacing that particular laptop programs offer provides teachers an opportunity to differentiate instruction for all students in the classroom.

*Effects of one-to-one computing on student motivation.* The significant benefit of using one-to-one computing is increasing student motivation. Students have more autonomy and ownership in learning academic content in one-on-one computing environments. Access to technology provides more choices for students, specifically those with disabilities, and can help express themselves in nontraditional ways (Hasselbring & Glaser, 2000). Providing students with a tool to choose how they will showcase their knowledge is very motivating for students. Digital-aged students feel empowered to use this familiar technology as compared to outdated textbooks and worksheets. Students become more motivated to learn and discover new information with the teacher by utilizing laptops. Rather than a sit and get dictatorship, students become intrinsically motivated to partner with the teacher to learn.

Student motivation was revealed in a quantitative study of 105 high school students conducted by Keengwe et al. (2011). The researchers examined "how 1:1 laptop initiatives affected student learning" (p. 139). The study was conducted in a rural Midwestern high school to students in grades 10 through 12. The researchers created
surveys to collect data from students and teachers. Forty students responded to the likert-type survey. The majority of the respondents, 79.5% or higher, agreed or strongly agreed that laptops made schoolwork easier to do, improved the quality of their work, and helped prepare them for their futures. Seventy percent of students responded that they completed more homework if they were able to use a laptop and 62.5% agreed they were more motivated to complete school work with a laptop (Keengwe et al., 2011).

Teachers were also surveyed to determine their perceptions of student academic performance when using 1:1 laptops. Forty-two teachers responded to the likert-scale survey. The faculty perceived that most students used laptops to search for information, organize information, communicate using e-mail or instant messaging, complete homework, or work on website, digital, or film/media (Keengwe et al., 2011). Faculties’ perceptions were also surveyed to determine the impact 1:1 laptops had on traditional, at-risk, and high achieving students’ achievement and learning. The three areas that were perceived to be improved in each group of students were motivation, engagement and interest level, and ability to work independently (Keengwe et al., 2011).

The conclusion drawn from this study was that 1:1 laptops had a positive effect on all students’ learning experiences. Winking (2009) listed the benefits of 1:1 laptops for students and teachers which included:

improved academic achievement, higher rates of attendance, better student engagement in the 21st century learning process, parental satisfaction with educational systems, improved teacher ability to prepare students for the 21st century, and a greater ability to meet the changing needs of students, teachers, and parents (as cited in Keengwe et al., 2011).
Increased use of technology was not only evident in school and at home, but students were also more engaged and motivated to learn the content with 1:1 laptops.

Student engagement and motivation were also evident in Mouza's (2008) quasi-experimental design study. The researcher investigated "the implementation of a laptop program in a predominantly low-income minority school and its potential to bridge the digital and didactic divide by providing students with enriched learning experiences both within and outside school borders" (p. 449). Three laptop classrooms were purposefully selected based on the classroom teacher's participation in professional development, evidence of technology integration, and willingness to participate. Third and fourth grade students were the participants in the laptop and non-laptop classrooms.

Data were collected qualitatively and quantitatively through classroom observations, teacher interviews, student questionnaires, and student focus groups. The data were gathered and coded in the following categories: "(a) student beliefs about computers, (b) student enjoyment from using computers, (c) student uses of technology at home, (d) motivation and attitudes towards school, (e) benefits from using computers, (f) classroom interactions with teachers and peers, and (g) student empowerment" (Mouza, 2008, p. 455). Quantitative data suggested fourth grade laptop students had more positive attitudes, enjoyed school, and directed their own learning compared to the non-laptop students. As a result, laptop students "became more motivated, exhibited greater academic engagement, and often went beyond required assignments" (Mouza, 2008, p. 468). Qualitative data revealed teachers who utilized technology enabled laptop students to engage in powerful learning experiences that resulted in increased "written expression,
preparation of multimedia presentations for an audience, and data analysis and interpretation" (Mouza, 2008, p. 468). Both quantitative and qualitative data showed that laptop students were motivated to learn resulting in more engagement and increased academic gains.

Student motivation was also examined in a mixed methods comparison study by Russell et al. (2004). They compared the teaching and learning context of fourth and fifth grade classrooms that was fully equipped with 1:1 laptops and classrooms that shared carts of laptops. Many educational leaders think increased access to computers will lead to an increased use of computers (Russell et al., 2004); however, two challenges still exist: (1) teacher preparation in integrating technology into their instructional practices, and (2) the ways computers are distributed throughout the school setting.

The authors of this study spent two months interviewing teachers, surveying students, and observing classrooms. Four classrooms were considered 1:1 (permanent) laptops and five classrooms shared a cart of laptops totaling 209 students and nine teachers involved in the study. During the observations "students’ engagement level, the number of students working with technology, the number of students working independently, in pairs, in small groups, or in large groups, and the role of the teacher was recorded every 10 minutes" (Russell et al., 2004, p. 317). Blind readers were asked to analyze the data collected to identify patterns or trends within each classroom.

In addition to the classroom observations, teacher interviews, and student surveys, the researchers asked students to respond to the following drawing prompt to gain further insight on students’ writing processes: “Think about the work you do in your classroom.
In the space below, draw a picture of yourself writing in school” (Russell et al., 2004, p. 317). The drawings were coded into four categories that included:

1) student characteristics (what the students were doing); 2) technology present (type of technologies depicted); 3) student demeanor (whether the student was depicted positively, negatively, or neutral); and 4) other features, which included the presence of the teacher, other students, or classroom decorations (Russell et al., 2004, p. 318).

After all these data were collected and analyzed, five major findings emerged. The first finding was that technology was used more frequently in 1:1 classrooms. Students in the shared classrooms reported using “15 minutes or less” and “15 to 60 minutes” a day during class time, whereas students in the 1:1 classrooms reported using technology “1-2 hours per day” and “2+ hours per day” (Russell et al., 2004, p. 318).

Data collection showed that students in 1:1 classrooms used technology 4 to 12 times more often than students using shared laptops. An interview response from a teacher who used 1:1 laptops was:

The ways in which they use technology are much more in depth: for presentations and note-taking they use PowerPoint, word processing is almost constant, the Internet has a much larger presence for science, social studies, and math. The instant gratification of available information has given the term research a whole new meaning for my students (Russell et al., 2004, p. 319; 321).

Another major finding in this study was that motivation and engagement was higher in the 1:1 classrooms. There was a statistical difference, .05, that the mean level of engagement for students in the 1:1 classroom was significantly higher than students who shared laptops. “One laptop teacher also reported that increased laptop access had ‘leveled the playing field’ between the special education students and the non-special education students” (Russell et al., 2004, p. 322).
The third finding from the study was that computers were the students' primary writing tool in the 1:1 classrooms. When given the drawing prompt, specifically, 90.9% of students described themselves writing using a laptop compared to 8.6% of students in the shared laptop classrooms.

Another finding showed that classroom structure differed between the 1:1 and shared classrooms. During classroom observations, 60% of students in the 1:1 classrooms were observed working alone, 4% in pairs, 1% in small groups, and 35% in large groups compared to the students in the shared classrooms, those percentages were 38%, 10%, 4%, and 48% respectively. This data relieved that students with access to 1:1 laptops tend to work more individually than when laptops were not accessible. When students were working together in the 1:1 classrooms, often times they were using their laptops as a peer conferencing tool or presenting their work.

The last finding in this study was that students in the 1:1 classrooms used computers at home more frequently for academic purposes. Data showed that students used their laptops at home to search the Internet for school and write papers more frequently than students who did not have 1:1 laptops.

In conclusion, technology use increased for a variety of academic purposes. Students with 1:1 laptops had increased engagement, time spent on writing, and classroom interactions between the students and teachers changed (Russell et al., 2004). These results were evident for both students with disabilities and their nondisabled peers.

Findings from the motivational studies revealed laptops leveled the playing field for students. This leveled playing field resulted in learning experiences that increased
students’ motivation to complete schoolwork. Laptop studies have shown increased student motivation and academic achievement, which could potentially decrease the achievement gap between students with and without disabilities. Laptops can provide the access to the general education curriculum students with disabilities need in order to be included in the least restrictive environment. Limited research exists in relation to one-to-one laptops and students with disabilities, which is surprising as technology integration is required in both NCLB and IDEA. One mixed methods study was found that “examined the design, implementation, and outcomes of a laptop technology initiative in a career and technical education high school, in which many of the students had identified learning disabilities” (Mouza, Cavalier, & Nadolny, 2008, p. 411). The results of the study found that teachers were able to differentiate their instruction more to meet the individual needs of their students. Part of this differentiation involved activities that corresponded to students’ interests, which increased “student motivation and produced improvements in writing and research skills” (Mouza et al., 2008, p. 448). Students also exhibited positive attitudes and acknowledged the importance of computers in their futures. Laptops can increase the motivational level of students with and without disabilities.

Capacity for student interaction and collaboration. One-to-one computing provides opportunities for students to interact and collaborate with other students, teachers, and parents from around the world (Karsenti & Collin, 2011). The Florida Learning Task Force (2004) found 1:1 laptops increased students' acquisition of 21st century skills. The Task Force also noted a change in pedagogy to a significant
movement towards constructivist teaching. The evaluation found that teachers who taught with laptops were more likely to "encourage student-led inquiry and collaborative work" (Barrios et al., 2004, p. 24).

Student interaction and collaboration were evident in a quantitative study conducted by Bebell and Kay (2010). The researchers tested "the efficacy of a one-to-one laptop initiative in transforming teaching and learning in a traditional middle school setting" (p. 7). The Berkshire Wireless Learning Initiative (BWLI) was a three-year pilot program conducted in five Massachusetts middle schools, which were then compared to two schools that did not use one-to-one laptops. Throughout the three years, data were gathered from teacher surveys, selected teacher interviews, student surveys, student drawings, analysis of existing school records and test scores, and classroom observations. The common trends from the data collection focused on four targeted outcomes: "fundamental shifts in teaching practices, improved student engagement, enhanced student research and collaboration, and enhanced student achievement" (Bebell & Kay, 2010, p. 17).

The first outcome found in the study showed that teachers who implemented the 1:1 program changed their teaching strategies, curriculum delivery, and classroom management. Teachers adopted and incorporated technology into new practices in classroom instruction. When the researchers surveyed teachers and students, it was found that no single subject area received universally high use at more than two BWLI schools, although social studies and English/language arts seemed to implement 1:1 computers more often than the math and science classes. Teacher surveys also showed that 83% of
teachers reported that their own computer skills improved from the beginning of the BWLI program. Teachers were increasingly using technology for teaching and recordkeeping. Of the teachers surveyed, 80% stated the delivery of curriculum changed, 60% thought the school climate changed, and 50% believed their role as a teacher in the classroom changed as a result of the 1:1 program. Only a small number of teachers reported they were negligibly impacted by this program.

The second outcome from Bebell and Kay's study was improved student engagement. In the final survey, teachers reported significant changes in student engagement and motivation, which showed 83% of teachers believed engagement improved for traditional students, 84% for at-risk/low achieving students, and 71% for high achieving students. Similar to these results, 73% of teachers thought traditional students' motivation improved, 76% of teachers believed low achieving students' motivation improved, and 59% for high achieving students. Principals who were surveyed reported that they noticed students' improved engagement, attentiveness, and motivation when laptops were being used.

Another outcome from the study showed evidence student research skills and collaboration were enhanced. Many students from the study reported that they used the Internet to access information. Once the 1:1 program was implemented, teachers assigned more projects that required students to use a wider variety of tools available on the computer such as multimedia, web pages, research, books, art, and many more. Students' interactions and collaboration with one another increased but not as significantly as the other outcomes. Survey results showed "44% of teachers reported increased student
interaction for their traditional students, 42% for their low-achieving students, and 39% for their high-achieving students" (Bebell & Kay, 2010, p. 25). Fewer than 7% of teachers reported a decrease in students' interactions. Results from teachers did show that students' ability to work independently increased after the program. "Across all 1:1 teacher respondents, 69% reported increases in their traditional students' abilities to work independently, 65% for low-achieving students, and 52% for high-achieving students" (Bebell & Kay, 2010, p. 25).

Enhanced student achievement was the last outcome found from the study. A teacher survey regarding their attitudes and beliefs towards the 1:1 program showed 71% of the teachers felt their students had "benefited greatly", 68% agreed Massachusetts middle schools should adopt 1:1 computing, and 60% agreed the "impacts of any 1:1 computing program may take many years to be fully understood" (p. 27). Although not significant, quantitative data showed an increase of BWLI schools' state test scores.

*Capacity for networked communication and materials management.* One-to-one computing can increase communication and assist students in organizing their materials. In the study conducted by Dunleavy et al. (2007), the researchers observed an eighth grade English class utilizing synchronous and asynchronous communication. The teacher created a collaborative poetry-writing exercise using an Internet based website for students to compose and share poetry. The students were required to individually write a poem and then post it to the discussion tab of the Internet based website. Once the students posted their poem, they needed to read a peer's poem and choose a word or
phrase from the poem as an anchor for a new poem. This process continued three times using only the threaded discussion from the website.

This lesson could have easily been done using paper and pencil; however, several benefits were identified by using laptops. The first added value to this lesson was that it minimized shuffling and passing papers that could be a management problem for some students. Deciphering peers' handwriting was not an issue when laptops were used. Another added value was that students could see what portions of their poems were integrated into others' poems. The theme was evident as students could look back through the threaded discussion. The next added value was that students' writing did not deteriorate as it typically did when the assignment was administered using paper and pencil. The students maintained quality writing and were relatively highly engaged in the task. The teacher also communicated to students through the threaded discussion what she wanted them to know, complete, and be able to do. This documented communication allowed students to reference it as much as necessary and work at their own pace. Accessibility was another added value. Because all the materials were online, students and parents could access the information outside of class, which promoted student autonomy and independence as well as parental awareness. The last added value of using laptops for the task was the savings on time and paper. Utilizing a threaded discussion provided a permanent record for the teacher and students and made the process easier and more efficient (Dunleavy et al., 2007).

The increased communication through computers has affected literacy skills of students. A multi-site case study conducted by Warschauer (2008) examined the
relationship of laptop use to student literacy practices in 10 schools in California and Maine. Five to seven students were chosen to participate from each school to represent the schools' diversity. Data were collected through classroom observations, teacher, school staff members, students, and parent interviews, teacher and student surveys, and document reviews. The findings from this study were reported in three categories: reading, writing, and Information and Communication Technology (ICT) literacy.

In the area of reading, three changes in the teaching and learning of reading were identified when laptops were used. "One-to-one laptops greatly expanded teachers' opportunities for scaffolding text" (Warschauer, 2008, p. 56), which provided support for students to read more challenging materials. Another change to the reading process was labeled epistemic engagement, which is the "active involvement in knowledge building" (Warschauer, 2008, p. 55). Laptops provided a plethora of opportunities for students to work together to create meaning from texts. The last change laptops made to teaching and learning reading was page to screen, which refers to the amount of reading done online. Much reading was done using the laptop by skimming and scanning content or summarizing information.

Laptops also affected the teaching and learning process of students' writing. Many stages of the writing process that were typically done with paper and pencil were done using the laptop. This increased accessibility to technology especially in assisting students who had difficulties in "coordination, motor skills, or cognitive function" (Warschauer, 2008, p. 58). The author of this study did highlight seven advantages of writing with laptops which included:
computer-based writing became more naturally integrated into instruction; the writing process became more iterative with students able to receive and respond to feedback better; writing became more public, visible, and collaborative; writing became more purposeful and authentic with students able to write things with real objectives; students took advantage of the formatting features of computers to write in multiple and diverse genres; by using computer-based language and formatting tools and by revising their work for authentic audiences, students produced higher quality writing in which they took more pride; many students became more autonomous in their writing and even engaged in creative writing during their free time (Warschauer, 2008, p. 60).

Information and Communication Technology (ICT) literacy consisted of the "ability to access, manage, evaluate, and make use of information and multimedia literacy or the ability to interpret and produce knowledge in multiple media and modes" (Warschauer, 2008, p. 60). The study found that the laptop changed the way ICT literacies were taught and learned. The changes that were impacted were: "more individualized learning, greater ease in conducting research, more empirical investigation, and more opportunities for in-depth learning" (Warschauer, 2008, p. 61).

Studies showed teaching and learning is substantially different in a laptop classroom compared to a typically classroom. Many 21st century skills such as collaboration, communication, and organization are taught and reinforced when laptops are integrated into instruction. The benefits of using one-on-one laptops could reduce the achievement gap and promote inclusive placements for students with disabilities.

**Summary of benefits to one-to-one computing.** The benefits of integrating one-on-one laptops have had an impact on the teaching and learning process. The benefits include the teachers' and students' abilities to formatively assess learning, individualize instruction through self-guided pacing, increased access to technology, increased student interaction and collaboration, and communication and materials management. The
integration of laptops into the school curriculum can facilitate the development of 21st
century skills.

One-to-one computing is a specific technology that can be seen as an alternative,
instructional methodology to teach students with special needs in inclusive environments
and to reduce the achievement gap. Because of the intrinsic motivation some students
have to utilize electronics, particularly males who are overrepresented in special
education programs, the use of one-to-one laptops may be a system to address the
achievement gap with students with disabilities when being educated in the least
restrictive environment. The purpose of this study is to examine the effects of technology
integration on students with disabilities when taught in inclusive classrooms. The
research questions guiding this study are:

1. How do teachers integrate one-to-one computing in an inclusive language arts
classroom?

2. What do teachers perceive as the learning benefits and barriers of using one-to-one
computing in inclusive classrooms?

3. What do students with disabilities perceive as learning benefits and barriers to one-
to-one computing?
CHAPTER 3
RESEARCH PROCEDURES

Introduction to the Research Methodology and Rationale

The purpose of this study was to examine the integration of technology with students with disabilities, particularly the use of one-to-one computing when used in inclusive classrooms. Much of the research conducted on one-to-one computing has been reported using quantitative measures; this study took a qualitative approach exploring how one teacher integrated one-to-one computing into the curriculum and how students with disabilities perceived that integration.

Much of the quantitative research asked about teachers’ perceptions. The teachers were trained how to use the technology and then asked by the researchers if the technology worked. Teachers’ natural inclination would be to say yes to that question, which is one criticism to using this type of quantitative research. For this study, qualitative research was selected as the methodology to reveal and provide more insight to teachers’ perceptions of technology. Qualitative research uncovered what students and teachers thought and felt about one-to-one computing. Another criticism of using quantitative research on one-to-one computing was that many of the studies targeted the general education population. This qualitative research focused on how one-to-one computing affected students with disabilities. Because students with disabilities are one of the subgroups on which schools must report data to meet the requirements of NCLB’s AYP, finding ways to increase the achievement of this population is critical.
According to Strauss and Corbin (1998), individuals conducting qualitative research hope their work has direct "relevance for both nonacademic and academic audiences" (p. 6) and should become completely absorbed in their work. Qualitative data could be gathered through researching a "person's life, lived experiences, behaviors, emotions, and feelings as well as organizational functioning, social movements, cultural phenomena, and interactions between nations" (Strauss & Corbin, 1998, p. 11). The three major components of qualitative research consist of data, procedures, and written and verbal reports (Strauss & Corbin, 1998). In this qualitative study, the researcher collected data through participant observations, which included transcripts of classroom activities and observational field notes, teacher interviews, student interviews, and a document analysis. The procedures used to interpret and organize the data in this study were coding and field notes. The last component of qualitative research could involve the researcher presenting the data from this study in journals or at conferences.

The methodology selected for this study allowed the researcher to "explore attitudes, opinions, and beliefs, . . . and examine personal reactions to special education contexts and teaching strategies" with hopes to examine the "constructive impact on individuals with disabilities" (Brantlinger, Jimenez, Klinger, Pugach, & Richardson, 2005, p. 196) within the school context. The context for this study was in a rural, Midwest, middle school.

**Site Selection**

This study was conducted in a small, rural, northeastern Iowa school district. The school district was currently comprised of three small communities. Because of low
enrollment, administrators were discussing the possibility of whole-grade sharing with a neighboring district. At the time of study, 853 students were enrolled in the district prekindergarten through grade 12. Of those 853 students, 93%, or 790, were Caucasian, and 36.6% qualified for free or reduced price lunches (Iowa Department of Education, 2012). The median household income in these communities ranged from $32,183 to $44,416, which was significantly less than the state's average income of $48,044. Property value in these communities ranged from $61,000 to $88,497 compared to the state's average of $122,000 (citydata.com).

The study was specifically conducted in a middle school, inclusive language arts classroom that had a one-to-one computing situation. Much of the researcher's teaching experience had been at the middle level. During this middle school period, the achievement gap between students with and without disabilities becomes most pronounced (Basham, Beecher, & Marino, 2011). This study specifically examined the impact one-to-one computing had on students with disabilities, so conducting the research in an inclusive language arts classroom allowed the researcher to determine if the students with disabilities made progress on their Individualized Education Program (IEP) goals and decreased the achievement gap between their nondisabled peers. Typically, most students with disabilities have either a reading or writing goal if not both.

The researcher wanted to conduct her study in a seventh or eighth grade classroom rather than a sixth grade classroom. One reason was the seventh grade class at this school had more students identified with disabilities than the sixth and eighth grades, which allowed more possible student participants. Another reason was the seventh and
eighth graders at this school "owned" their devices and were able to take their laptops home each night, whereas sixth graders were required to keep their laptops at school. This was the first year of one-to-one laptop implementation for grades 7 through 12 at this school.

A shift in teaching responsibilities occurred in late summer; the seventh grade teacher was moved into a new position and a new teacher was hired to teach seventh grade. The researcher did not want to ask the new teacher to be involved in the study as she would be learning new curricula and about the students. Shortly after school began, this teacher planned went on maternity leave. The eighth grade class was the researcher's choice as it was also located in the same building as the seventh grade.

**Letter of Cooperation**

The researcher emailed the superintendent of the school district asking permission to conduct her study in his district. The email explained the purpose of the research and the interest in working with a general education language arts teacher for nine weeks in the fall. After he spoke with the language arts teachers, he agreed that the researcher could conduct the study in the school district and wrote a letter of cooperation.

**Classroom**

The eighth grade language arts classroom was decorated to make students feel like they were at home. The room was carpeted, and the teacher handmade curtains, which hung over the windows. Five plants sat in front of the windows alongside the heat register. All the bulletin boards had decorated fabric for a background rather than colored butcher paper. On the east wall, which was the back of the classroom, the teacher had
five Chinese lanterns hung from the ceiling over two work tables. On the southwest wall, the teacher decorated a corner of the wall with personal pictures of her family and symbols of her profession such as an apple with teacher displayed on it.

The 22 feet by 23 feet classroom was very welcoming and promoted student learning and achievement. The classroom was organized with specific spots in the room designated for different resources. The United States flag and cubbies of themed books such as nonfiction, sports, growing up, and mystery were also located on the south wall. Student resources such as encyclopedias and dictionaries were found on shelves under the themed books. Two VCRs, an old cassette player, and head phones were found on the bottom shelf. An old overhead projector was sitting in the southwest corner beside an Elmo™ projector. The front of the room was the west side of the classroom where students faced a whiteboard, two bulletin boards, posters displaying the pillars of success: respect, caring, trustworthiness, fairness, responsibility, and citizenship, and a projection screen. A table, which could seat four, was located at the front of the classroom near an outlet so that students could work and charge their laptops at the same time.

Waist-high built-in cabinets lined most of the north side of the room. The teacher had a small refrigerator set on top of the cabinets in the northwest corner. The top of the cabinets was predominantly used to display books for students to check out. A sink, soap dispenser, and paper towel holder were located at the east end of the cabinets. Two bulletin boards with information pertinent to the student such as the lunch calendar, band schedule, activity calendar, sports schedules, and inspirational quotes were located over
the cabinets. The teacher had a phone mounted on the wall next to the door leading to the hallway.

A bulletin board for the Reading 8 class was displayed on the east wall, which is the back of the room next to the door leading to the hallway. A floor-to-ceiling storage cabinet was located between the bulletin board and two work tables, which were pushed up against the wall. Four students could sit at these tables and three extension cords were available for students to charge their laptops and work. The teacher's desk was diagonally placed in the southeast corner so that she could see all students' laptops while they were working. An emergency exit that led directly outside was located behind the teacher's desk. The school's mission and vision statements were hung on the south wall behind the teacher's desk. A table, where the associate kept her things, was located in front of the teacher's desk along the heat register on the south side of the room.

Eighteen students were in this inclusive language classroom yet 21 desks were arranged in five rows in the middle of the classroom facing west. The teacher had her laptop on a rolling cart in the southwest corner of the room beside a podium. A cabinet of teacher resources was located behind the podium. The teacher provided instruction to the class by plugging her laptop into the cord for the liquid crystal display (LCD) projector. This allowed students to see the information on the large projection screen and know what website to pull up on their laptops. The students were given ample time to work in class on completing their assigned tasks either independently or with a partner.
Since the purpose of this study was to determine how one-to-one technology was integrated into the curriculum to increase academic achievement and promote inclusive placements for students with disabilities, the general education language arts teacher must have had access to one-to-one computing. Once the letter of cooperation was received, the researcher emailed the eighth grade general education language arts teacher, Kim, to see if she was willing to be a participant in the study. After she agreed via email, the researcher sent Kim the consent form to read and sign. The researcher and teacher participant met before the study was conducted to arrange dates for classroom observations and interviews.

Kim was in her 26th year of teaching eighth graders reading and language arts. All of Kim's teaching experience had been in the same school district. After beginning her teaching career, Kim went back to school and earned her master's degree. Kim was currently teaching language arts, digital literacy, and second chance reading to eighth graders.

In Kim's first or second year of teaching, she bought her first computer for her home. Her principal at that time was very interested in technology and created a mini lab for students to use. Teachers could also sign up to take their classes to the lab to work. Kim described this as being "very much ahead of time" (personal communication, September 27, 2012) because the junior high at the time had more technology than the high school. Because of the progressive principal Kim had, she started putting students on computers 25 years ago. As new technology became available and the district
upgraded computers, she was able to do more things. She started by introducing students to Word documents and then the next generation of computers came along for her to use the Internet. Kim said, "All of sudden the world was open to us" (personal communication, September 27, 2012).

Kim really started integrating technology 15 years ago when she started to use it in different ways with students. Kim taught a computer course for eighth graders for two years and currently has implemented one-to-one laptops. Again, Kim described this as "the world is open to us" (personal communication, September 27, 2012).

Kim prepared for the move to one-to-one laptops by spending 18 months prior to the implementation taking classes and the last seven to eight years attending every workshop she could related to technology. She and her colleagues even created their own professional development designed to meet their needs to help them continually update their knowledge of technology. Kim said technology has been a special interest of hers throughout her teaching career.

**Students**

The inclusive language arts classroom was comprised of both special and general education students. For the purpose of this study, only students with disabilities were observed and interviewed. The determination of the number of students the researcher interviewed depended on the number of students who were eligible for special education services.

After Kim had consented to be a participant, the researcher worked with her to identify possible student participants. For confidentiality, the researcher gave Kim the
parent permission letters and a copy of the child's assent form as well as a self-addressed, stamped envelope to be sent back to the researcher if the parents granted permission for their child to be in the study. Kim mailed the information to the students' parents via the school district envelopes so that the parents opened them. Only three of the 58 students in eighth grade class had IEPs and two of them were included in the inclusive general education language arts class Kim taught. The parents of both students granted permission for their sons to be in the study.

**Tom.** Tom was a 15-year-old, eighth grade boy with an IEP goal in the area of math. Tom has been clinically diagnosed with Attention Deficit/Hyperactivity Disorder (ADHD). Tom was typically one of the last ones who completed a task or assignment. According to Kim, she hadn't determined if he processed things that much slower or if Tom would benefit from an IEP goal in literacy.

Tom had some technology at home. The technology included cell phones, house phones, a laptop, T.V.s, an iPod, and video games such as PlayStation Portable (PsP) and Nintendo DS. Tom did not have Internet access at home. He could access it through his mom's cell phone, which had an Internet Bluetooth to hook up to the computer. The iPod was his sister's and he listened to music when she let him borrow it. When he had his work completed, he was allowed to play his video games. He used his cell phone to call friends and family and text them.

**Mitch.** Mitch was a 13-year-old, eighth grade boy with mild learning disabilities whose IEP included goals in the areas of reading and writing. Mitch had been around technology since the age of five and liked to take apart and put his desktop computer
back together. Mitch worked well independently as well as in groups. He answered questions Kim asked in class and also knew how to navigate through his laptop. He liked having his "own" laptop at school because then he "didn't need to worry about who needed it next" (personal communication, October 3, 2012) as compared to previous years without one-to-one laptops.

Mitch also had access to technology at home. He had phones, televisions, gaming consoles like Xbox 360 and a Wii, a laptop, and a desktop computer. Mitch did have Internet access at home and liked to play strategy games on his computer. One strategy game took place during the Revolutionary War. When Mitch played, the game instructed him to research specific technologies to complete the mission.

Data Collection Procedures

This qualitative research used four forms of data collection. The researcher used participant observations, which included transcripts of classroom activities and observational field notes, teacher interview, student interviews, and a document analysis to examine the research questions.

Participant Observation

The researcher in this study became a part of the school setting and "learned firsthand how the actions of research participants correspond to their words; saw patterns of behavior; experienced the unexpected, as well as the expected; and developed a quality of trust, relationship, and obligation with others in the setting" (Glesne, 2006, p. 49). Establishing appropriate areas of investigation is an important goal at the beginning of any research, which can be determined through participant observations. Once the areas
of investigation were established, the researcher continually observed through the data collection period. The researcher observed the nature of the technology integration into the curriculum, teacher facilitation of the technology, and peer interaction. The continuum of participant observation ranges from the researcher mostly observing to mostly participating. The four distinct points on the continuum are observer, observer as participant, participant as observer, and full participant (Glesne, 2006). The researcher's role as an observer has no interaction with those being studied. In fact, the people do not know they are being observed. The researcher remains primarily an observer but has some interaction with the study participants in the role of observer as participant. The researcher could be taking field notes from the back of the classroom. The researcher would not teach, give advice, or assist teachers, students or administrators. The third point on the participant observation continuum is a participant as observer. In this role the researcher becomes more of a member of the world he/she is researching. The researcher has a greater opportunity to learn in this role yet risks losing the perspective of an uninvolved outsider. The last role is a full participant. In this role the researcher may seek employment in an agency to determine the inner workings. This point causes a dilemma between the conflicting roles of a researcher and employee (Glesne, 2006). For the purpose of this research, the researcher acted as the role of an observer as participant.

Few goals guide participant-observation. The main goal is to "understand the research setting, its participants, and their behavior" (Glesne, 2006, p. 51). The researcher did not preach, evaluate, or compete for prestige. Another goal of participant observation is to "make the strange familiar and the familiar strange" (Glesne, 2006, p. 51). This
means the researcher needed to understand the context in which they observed to provide new vantage points and way of thinking about similar topics. Six quality indicators for participant observations exist. The setting and people selected for the observation have to be appropriate for the study and sufficient time has to be spent in the field. The researcher has to be accepted, respected, and unobtrusive during observations, and field notes should be systemically collected. Because this is not action research, research should have minimal impact on the setting and sound measures should ensure the confidentiality of the participants and setting (Brantlinger et al., 2005). The researcher strived to meet those quality indicators.

For this qualitative study, the researcher observed and took field notes one to two times a week in the same 80-minute inclusive language arts class for nine weeks. The researcher sat in the back of the room unobtrusively during each observation and took field notes while digitally audio recording. The researcher's field notes focused on three main sources of data that involved the nature of the technology integration into the curriculum, teacher facilitation of the technology, and peer interaction. The researcher became immersed in the setting, participants, and the research questions to enhance her awareness and curiosity about the participants' interactions with one-to-one technology. The researcher only observed and did not interact within the classroom. After each observation, the researcher transcribed and analyzed her observations for meaning and evidence of personal bias. Interview questions were also developed through participant observations.
Teacher Interview

Interviews are an "occasion for close researcher-participant interaction" (Glesne, 2006, p. 105). According to Brantlinger et al. (2005), quality indicators for conducting interviews exist. An adequate number and representation of participants are appropriately identified and recruited for the study. Once participants are selected, interview questions must be clearly worded, not leading, and appropriate for exploring domains of interest. During and after the interviews, adequate mechanisms are used to record and transcribe the data. When sharing the results from the interviews, participants should be represented sensitively and fairly ensuring confidentiality for the participants.

For this study, the researcher conducted three rounds of interviews with the general education language arts teacher throughout the nine weeks of observation to verify the trustworthiness of the data. Each interview session was redesigned and structured based on the responses from the previous interview. Three types of interviews exist, structured, open, and depth-probing. The researcher specified questions she wanted to ask during structured interviews. During open interviews, the researcher was prepared to "develop new questions to follow unexpected leads that arise in the course of the interview" (Glesne, 2006, p. 104). Depth-probing interviews required the researcher to capture how the respondents think or feel about something by asking them to further explain or tell more about their response. Each round of interviews had a different purpose; therefore, different types of interviews were utilized.

Each interview was digitally audio recorded and transcribed immediately after. Interviews lasted approximately 45 minutes to one hour depending on the amount of
follow-up questions that were generated. Data were transcribed and coded by the researcher based on themes and patterns from the responses. Questions for the first interview round were formulated from the literature review and conceptual framework conducted by the researcher. The second interview round was conducted to confirm the data obtained from the first interview. Once emerging themes were identified following the third round interviews, member checks occurred.

A semi-structured interview format was used. The first round of interview questions was demographic in nature and utilized the constructivist theoretical framework to frame questions regarding the access to one-to-one computing. The guiding questions for the initial interview can be found in Appendix A.

**Student Interview**

The purpose of the student interviews was so the researcher could discern the students' perceptions in regards to one-to-one computing. Only students with disabilities in the inclusive language arts class were interviewed. Parent permission was obtained prior to any interviews, and students were made aware of the purpose of the interviews by asking for their assent. For this study, the researcher conducted three rounds of interviews with each student participant throughout the nine weeks of observation to verify the trustworthiness of the data. Each interview session was redesigned and structured based on the responses from the previous interview. Each round of interviews was conducted individually with each student participant during his directed study time (DST). Since the students' DSTs occurred in the special education classroom, the researcher had to arrange interview times with the special education teacher. Interviews took place in a private...
setting such as the counselor’s office or the vacant faculty lounge and lasted approximately 20 to 40 minutes depending on the amount of follow-up questions that were generated. Each interview was digitally audio recorded and transcribed immediately after.

A semi-structured interview format was used. The first round of interview questions were demographic in nature and utilized the motivational theoretical frameworks to frame questions regarding one-to-one computing. The guiding questions for the initial interview can be found in Appendix B. The second and third round interviews were conducted in the same way as described above for the teacher.

Document Analysis

The document analysis served as way to review the school district’s archival data. The archival data determined the demographics on the technical support. Such data revealed what technologies the school district had, the adequacy of the Internet, the efficiency of the wireless Internet, and what kind of technical support they had. The school district’s technology plan was accessed and reviewed to determine the goals the district had for integrating technology, the expectations regarding one-to-one utility, and use of online plans. Specifications of the hardware used throughout the district and the technology plan, which are district initiated activities, were explored. Any questions regarding these documents were directed to the technology coordinator as a point of clarification.
**Data Analysis Procedures**

In qualitative research, the researcher has the task to ensure that the collection of data are credible and trustworthy (Brantlinger et al., 2005). Data triangulation that includes participant observation, teacher interviews, and student interviews was used in this study to collect a variety of data sources. The researcher "attempted to understand and self-disclose assumptions, beliefs, values, and biases" (Brantlinger et al., 2005, p. 201) when collecting her data. Member checks were conducted to confirm the accuracy of the teacher's and students' interview responses. An audit trail was recorded to keep "track of interviews conducted and/or specific times and dates spent observing as well as who was observed on each occasion" (Brantlinger et al., 2005, p. 201). This ledger of information justified and confirmed that a sufficient amount of time was spent in the field so that results were dependable.

Quality indicators exist when analyzing data in qualitative studies (Brantlinger et al., 2005). First, the results were sorted and coded in a systematic and meaningful way. Second, sufficient rationale was provided to explain what was and was not included in the finding. Third, documentation of methods was clear in establishing the trustworthiness and credibility of the data. Fourth, the researcher's reflection about her personal position was provided. Fifth, data conclusions were substantiated by "sufficient quotations from participants, field notes of observations, and evidence of documentation inspection" (Brantlinger et al., 2005, p. 202). Finally, the researcher made connections with the related research.
Corbin and Strauss (2008) describe a three-tier approach to data analysis: open coding, categorization, and axial coding. After the researcher collected raw data, coding was completed (see Appendix C). Coding is defined as "extracting concepts from raw data and developing them in terms of their properties and dimensions" (Corbin & Strauss, 2008, p.159). This required the researcher to think outside the box and abstractly by putting aside preconceived notions that she expected to find. Open coding begins the analysis process by brainstorming possible conceptual labels for the data. Conceptualizing the data provided a language for the researcher to talk about the data. These concepts ranged from low-level to high-level concepts. Low-level concepts are specific to the participant, whereas high-level concepts are categories/themes that tell "what a group of lower-level concepts are pointing to or are indicating" (Corbin & Strauss, 2008, p. 160). Coding by themes required the researcher to think and reflect on the raw data that were acquired through interviews. Axial coding goes hand-in-hand with open coding (see Appendix D). Axial coding is defined as the "crosscutting or relating concepts to each other" (Corbin & Strauss, 2008, p. 195) and what Glesne (2006) describes as constant comparative. The researcher used codes identified in open coding to form axes with similar codes. Categories were then named based on the codes in the axis. Data triangulation included data collected from teacher and student interviews, transcripts of classroom activities, and observational field notes to develop themes.

First Round Data Collection

After the initial interviews were conducted and transcribed, the researcher highlighted key words from each participant's responses. Some key words that were
highlighted in Kim's interview included: Moodle, differentiate, time, glitches, additional responsibility, individualized instruction, no stigma, and immediate feedback. After the transcribed interview was reread and key words and phrases were highlighted, the researcher used Microsoft Excel to organize the data into axes. Each axis had similarities so the researcher came up with or used data from the participant's interview to describe the axis. Data from opening coding included: special interest, troubleshooting, additional responsibility, still working, lots of back tracking, efficient, easier to differentiate, and no stigma. These data were organized in an axis labeled "How you feel about technology." This label became a category for that data. Another category that was used was called "How technology was used" in which the following data were used: Venn diagram, Moodle, immediate feedback, individualized learning, video clips, DesCartes for MAPs, diagnostic, and STAR Reading program. Teacher interview was just one source from which data were collected.

Coding from the transcripts of the classroom activities and coding from observational field notes were then added to existing categories created from interview codes or new categories were developed based on new axial coding. Transcripts of the classroom activities were defined as the transcripts the researcher used from the audio recording of each classroom observation. Codes from direct quotes or phrases said by Kim were how the data were established. Some data from the transcripts of the classroom activities that fit under the existing category of "How students use technology" included codes such as: classtools.net, interactive Venn diagram, organized ideas, sent message in email to teacher, used clipart on Keystone website, online quizzes, learned at their own
pace, and reviewed grammar PowerPoints found on Moodle. Most codes from the transcripts of classroom activities easily fell under a category from interview data. One new category was created based on data from the transcripts of classroom activities, which was "Teacher expectations of the students." Codes that fell under this category included: watch the screen here, hands off the computer, make a conscience choice, habit of saving in language arts folder, do this with me, don't jump ahead of me, and read the directions. For the first round of data collection, transcripts of the classroom activities and observational field notes consisted of four 80-minute classroom observations over the course of a three-week period.

Observational field notes were the last source of data collection. Observational field notes were defined as the researcher's personal notes based on what she saw the participants doing throughout the classroom observations. The data from observational field notes all fell into existing categories that were developed based on codes from the interview. Codes from the observational field notes, specific to Kim, which fell under the existing category "Barriers to integration" included: troubleshoot student's computer and called tech personnel. Data were also added to the category "How technology was used," which included codes such as: Mimeo pad, monitored students' progress, provided opportunities for students to learn independently, checked students' scores from online quizzes, and modeled expected skills. Data compiled for Kim were based on the convergence of interview data, transcripts from classroom activities, and observational field notes, which provided multiple lenses in the analysis of data.
The researcher also used data from two student participants for data analysis. The researcher used the same process for analyzing the data as she used for Kim: open coding, axial coding, and categorization, based on a convergence of interview data, transcripts from classroom activities, and observational field notes. When both participants' data were collected, the researcher did a constant comparison between their data. Common data found between the two student participants were codes that fell into the following categories: uses of technology, benefits of 1:1, effects on academics, life without laptops, and policy. Codes common under the category "Benefits of 1:1" were easier, simpler, my own laptop, and more responsible. These data were a compilation of data obtained through transcripts from classroom activities, student interviews, and observational field notes.

After all the data from each participant were coded and categorized, the researcher used those codes to write validation statements based on the first round interview responses. One example of a validation statement and question used on Kim was:

Some of the barriers to 1:1 technology that you mentioned last time were that the Internet gets overloaded sometimes in the late afternoon, and you are concerned that reading comprehension may be a barrier for your lower ability readers when they need to read information in Moodle. Have you seen other barriers?

The same process of validating first round interview responses was used for the student participants. The researcher also asked Kim questions based on students' responses and data collected through transcripts from classroom activities and observational field notes. A follow-up question asked of Kim based on student interview responses was: Are there times when students are on the computer and have been off-task? How is this handled?
The researcher also asked Kim a question based on her transcripts from classroom observations and observational field notes: I noticed that Tom often doesn't complete assignments in this period of time. Does his behavior affect how you use technology? Questions were also asked of the student participants based on Kim's interview responses and the researcher's transcripts of classroom activities and observational field notes.

Based on the data from the first round interviews, transcripts of classroom activities, and observational field notes, targets for the second round data collection were established. Targets for the second round observational data collection included individualized supports, peer interaction, classroom management, teacher facilitation of the technology, and student's interaction with the technology. The first round observational data revealed that the technologically based supports were individualized. Rather than using the technology in an interactive or small group setting, the availability of these supports was clearly student to student. Therefore, one targeted area of interest for the second round observations was to confirm this individualized support and explore other applications. Because of this individualized instruction, little peer interaction was observed or recorded. Special attention was given to classroom activities that provided students opportunities to interact or work in small group settings during the second round observations. Classroom management was another targeted area for second round observations as some students had a tendency to get off-task while Kim allowed time to work. During each student interview, participants described how their peers find ways to look on other websites when they are supposed to be working on a specific task. Questions were asked of Kim, and field notes were recorded on this targeted area.
constant focus for the researcher was to determine how the teacher used technology in her instruction and how students interact with the technology. Data related to these targeted areas were a constant focus throughout the observational data collection procedure.

**Second Round Data Collection**

The researcher used the validation statements and follow-up questions for the second round interviews. During this time, the researcher continued to observe and digitally audio record the 80-minute classroom once a week and take observational field notes. After all the data were transcribed, the researcher coded and categorized the data for each participant. For Kim, several codes were identified from her second round interview such as: builds confidence, glitch, provide choice, breaks my heart, hounding tech people, and still need human element (see Appendix C). Once all the codes were sorted into axes, the researcher then came up with a category to identify all the codes. One example of a category was called “Students with disabilities” and included codes such as: lesson design, given information, construct own knowledge, work in pairs, small groups, check in regularly, opportunity, participate, contribute, ideas, don’t feel incapable, adjust lessons, needs of individual students, and make adjustments (see Appendix D). Several other categories were established based on the codes highlighted from Kim’s interview.

Coding from the transcripts of the classroom activities and coding from observational field notes were then added to existing categories created from interview codes or new categories were developed based on new axial coding. Some data from the transcripts of the classroom activities that fit under the existing category of "Immediate
feedback" included codes such as: models process step by step, I'm going to show you, and I will answer individual questions. Most codes from the transcripts of classroom activities easily fell under a category from interview data. One new category was created based on data from the transcripts of classroom activities, which was "Technology used."Codes that fell under this category included: Google presentation, online resources, HyperStudio presentations, new version of STAR Reading program, Mystery Skype, flashcardmachine.com, and MyAccess. Data gathered for the second round consisted of three 80-minute classroom observations over the course of a three-week period.

Observational field notes were the last source of data collection. The data from observational field notes all fell into existing categories that were developed based on codes from the interview. Codes from the observational field notes, specific to Kim, which fell under the existing category "Immediate feedback" included: hurried around the classroom to help each student and positive feedback when students practiced Skype as well as what to work on for their Mystery Skype. Data were also added to the category "Classroom management," which included codes such as: pairs of students were off-task, students at different stages of registering for flashcardmachine.com, and made sure student was on-task. Data compiled for Kim were based on the convergence of interview data, transcripts from classroom activities, and observational field notes.

After the convergence of data was completed, the researcher went back to the first set of codes and reorganized them across a different set of axes based on the information she gathered from the second set of data collection. A constant comparative was done between Kim’s first and second set of codes (see Appendix E). The researcher found
common codes between the two sets of axes and reorganized them into six categories. The categories included: students with disabilities, barriers of technology, technology used, benefits of technology, teacher perspective on technology integration, and digital literacy. Originally, the researcher had a category of “Teacher perception on student use with technology” for her first round data collection and “Immediate feedback” for her second round data collection. The researcher found that the codes that fell under those two categories were best described by using a new category of “Benefits of technology.” Examples of common codes that were included under this category included: match student and learning, wide variety of ways to differentiate, immediate feedback, individualize instruction, hit on different learning styles, different types of exercises, diagnostic tool, and adjust lessons. These codes originated from Kim’s responses from her first and second round interviews.

The researcher then compared Kim’s data obtained through the first and second set of transcripts from classroom activities. The common codes from these data fell nicely into the aforementioned categories established during Kim’s constant comparative. The researcher added use multiple learning styles, you can choose your partner, differentiate, and model step by step the process under the existing category “Benefits of technology” based on the transcripts from classroom activities.

Observational field notes written by the researcher from the first and second rounds of data collection were compared in the same way as the transcripts from the classroom activities. The researcher added the codes target skills for individuals based on diagnostic information, modeled everything she did, and positive feedback when practice
Skype as well as what to work on to the category “Benefits of technology.” The constant comparative that was completed for Kim helped the researcher narrow her focus to reoccurring codes from the first and second rounds of data collection.

The researcher then used these data to come up with validation statements and questions to ask for the third round interviews based on targets observed from the second round, literature review, theoretical framework, and research questions (see Appendix F). An example of a validation statement and follow-up question that was written based on the target area of classroom management was:

When I asked if 1:1 laptops had impacted your classroom management or changed your rules and expectations, you said that you moved your desk so that you could see students’ computer screens. You said you have always roamed around the room, but do it more so that students will ask questions rather than just push a button if they are not sure. You didn’t think a whole lot else has changed for classroom management. Have you done or plan on changing any of your classroom management techniques because of the integration of 1:1?

The researcher then coupled the content from her literature review with data already collected to ask subsequent questions related to the barriers of technology, the benefits of technology aligned with 21st century skills, promoting inclusive placements for students with disabilities and increasing access to the general education curriculum, and supporting literacy instruction for students with disabilities. An example of a validation statement and follow-up question related to the barriers of technology integration was:

I also asked you if you have seen other barriers besides the ones you already mentioned, saving files and being able to transfer that home. You said just the difficulty of some students not having equal access to the Internet when they take their computers home. You said that some students don’t know as much about computers as others, but you didn’t think that was any different than students who have deficits in certain areas in a traditional classroom. How do you handle this in your classroom?
Based on my literature review, access was considered to be a resource barrier for the integration of technology. Another question that was asked focused on promoting inclusive placements and increasing access to the general education curriculum. The researcher asked:

Another part of literature suggested that I reviewed the law in terms of the need to promote inclusive placements for students with disabilities and access to the general curriculum. Do you have any comments about the relationship between instructional technology and those requirements?

The researcher also coupled the content from the theoretical framework with data already collected. Motivational theories, constructivist theory, and Gagne's conditions of learning frameworks were used to create questions. One example of a validation statement and follow-up question asked about motivational theories was:

When I asked you to tell me more about how students are more motivated and engaged when they complete assignments using technology, you said that when you watch students sometimes they are totally focused on their computers and what they doing online. You wondered if this was totally good. You said that online threaded discussions are a different type of engagement where students are talking with one another online. You said that kids are so focused on technology that engagement just occurs. Do you have any other comments on the motivational effects of instructional technology?

Other questions were asked that focused on the constructivist and conditions of learning theories. Research questions were then coupled with the data to extract any other information that was not brought up in the interviews or seen in the data collection. Kim's data helped answer two of the three research questions: How do teachers integrate one-to-one computing in an inclusive language arts classroom? and What do teachers perceive as the learning benefits and barriers of using one-to-one computing in inclusive classrooms? One example of a question related to the perceived learning benefits was:
So far you have told me all these benefits of 1:1 learning: student engagement rises, students are more motivated, builds confidence, find success, students are comfortable working in groups across the room, students can practice a skill multiple times at their appropriate instructional level, they are active in Moodle discussions, students get immediate feedback, it's easier to differentiate to individualize learning, you hit different learning styles, provide opportunities for students to learn independently at their own pace, no stigma. Can you think of any other benefits?

Other questions were asked that aligned with the targets observed from the second round data collection, literature review, theoretical framework, and research questions.

The researcher used the same process for analyzing the data for the two student participants as she used for Kim: open coding, axial coding, and categorization, based on a convergence of interview data, transcripts from classroom activities, and observational field notes. The researcher then went back to the first set of codes for each student and reorganized them across a different set of axes based on the information she gathered from the second set of data collection to come up with new categories. After the researcher completed each student’s constant comparative between rounds one and two, she did a constant comparative across both student participants. Common codes were: don’t throw laptop somewhere, used Gmail or Google docs, shared computers, easier to access information, charge them every night, and help us learn how to do each step.

Codes were then organized in axes and categorized. An example of one axis was: want to help others, work with partner on something and don’t have to be in the same place, used Gmail or Google docs, and collaborate with partner, which were categorized as “Peer interaction.” The constant comparative consisted of codes from the students’ interviews, transcripts of classroom activities, and observational field notes.
The researcher used the same process for creating validation statements and follow-up questions for the two student participants as she used for Kim. All questions were organized based on targets observed from the second round, literature review, theoretical framework, and research questions. For the student participants, data were collected to answer two of the research questions: How do teachers integrate one-to-one computing in an inclusive language arts classroom? and What do students perceive as the learning benefits and barriers of using one-to-one computing in inclusive classrooms? One example of a question related to the perceived learning benefits asked of Mitch was:

You told me last time that you think your grades and test scores have improved in language arts, math, and on MAPs testing since you have used 1:1 technology because you now go home and will write a random passage and then delete it or go to the Internet and practice math problems on Cognitive Tutor. Do you think you would have done this if you didn't have laptops? If you were going to convince a teacher next year to keep using these laptops, what would you tell that teacher about the reasons?

Both student participants were asked an open question to list any other learning benefits or barriers that 1:1 laptops have caused.

Third Round Data Collection

After all the data were transcribed from third round interviews, transcripts of classroom activities, and observational field notes, the researcher coded and categorized the data for each participant. For Kim, several codes were identified from her third round interview such as: leveling the playing field, underutilization, more choices is a motivator, immediate feedback, type comments electronically for students. Once all the codes were sorted into axes, the research then came up with a category to identify all the codes. One example of a category was called "Teacher perspective on technology"
integration" and included codes such as: more emphasis, administrative directive, management style, problem-based learning, teaching more of the processes, monitoring, different depths to meet Iowa Core, and type comments electronically for students. Several other categories were established based on the codes highlighted from Kim’s interview.

Coding from the transcripts of the classroom activities and coding from observational field notes were then added to existing categories created from interview codes. Some data from the transcripts of the classroom activities that fit under the existing code of "21st century skills" included codes such as: I’m typing too fast? I’ll move content down so you can see it, reaction to Skype, help with presentation to the school board, primary source document, two useful resources, and acceptable use policies. Most codes from the transcripts of classroom activities easily fell under a category from interview data. Data gathered for the third round consisted of three 80-minute and one 60-minute classroom observations over the course of a three-week period.

Observational field notes were the last source of data collection. The data from observational field notes all fell into existing categories that were developed based on codes from the interview. Codes from the observational field notes, specific to Kim, that fell under the existing category "21st century skills" included: had students collaborate to complete a story map, analyze poem and online information, talked individually to a pair of students who were not working together to complete a task, and encouraged more
collaboration between pairs. Data compiled for Kim was based on the convergence of interview data, transcripts from classroom activities, and observational field notes.

After the convergence of data was completed, the researcher went back to the first and second set of codes and reorganized them across a different set of axes based on the information she gathered from the third set of data collection. A constant comparative was done between Kim’s first and second set of codes and the third set of codes (see Appendix G). The researcher found common codes between the two sets of axes and reorganized them into five categories. The categories included: students with disabilities, barriers of technology, technology used, benefits of technology, and teacher perspective on technology integration. Established categories from the constant comparative and direct quotes from Kim’s interview were used as a springboard to develop emerging themes. Categories such as: benefits of technology, immediate feedback and 21st century skills emerged into the theme Motivation: “The Power of Choice.” A direct quote from Kim’s interview, “This is still very new” was used in conjunction with categories such as barriers to technology and digital literacy to develop the theme “This Is Still Very New”: A Teacher’s Perspective on Technology Integration.

The researcher used the same process for analyzing the data for the two student participants as she used for Kim: open coding, axial coding, and categorization, based on a convergence of interview data, transcripts from classroom activities, and observational field notes. All questions asked in the third round were also organized based on targets observed from the second round, literature review, theoretical framework, and research questions. After the convergence of data was completed, the researcher went back to the
first and second set of codes and reorganized them across a different set of axes based on the information she gathered from the third set of data collection. A constant comparative was completed between Mitch’s and Tom’s constant comparatives after all rounds of data collection (see Appendix H). Categories from the constant comparative and direct quotes obtained from Mitch’s or Tom’s interviews were used as a catalyst to develop themes that emerged from student data.

Following the final round and the emergence of themes, the researcher constructed brief narratives to share with the students (see Appendix I) and a more detailed narrative to share with Kim (see Appendix J). A member check was then conducted to present the researcher’s themes to the students and Kim to confirm the authenticity and accuracy of their interview responses, transcript of classroom activities, and observational field notes. In response to the member check, Kim clarified that Naiku was an online resource rather than a learning management system. She also provided feedback in regard to the software/program heading. Kim suggested using online assessments rather than programs since MAPs and the STAR Reading program are considered online assessments and HyperStudio and MyAccess are software programs that the school purchased. When discussing the third theme, "Leveling the Playing Field": Students with Disabilities, Kim stated, "One thing that you could even add here, is sometimes it's the student who has disabilities who's becoming the teacher to the peers" (personal communication, December 11, 2012). When the researcher presented the themes to Tom, he suggested that playing games and using Facebook is done at home rather than at school. This information was discussed under the first theme, "How to
Work with Technology": Student Use of Technology. While conducting the member check with Mitch, he agreed with all the themes and the data outlined under each. He didn’t add, move, or discard any of the data.

In response to the research questions, five themes emerged from the teacher data. The themes include (1) “The World Is at Their Fingertips”: Uses of Technology, (2) Motivation: “The Power of Choice,” (3) “Leveling the Playing Field”: Students with Disabilities, (4) “This Is Still Very New”: A Teacher’s Perspective on Technology Integration, and (5) “It Breaks My Heart”: The Underutilization of Technology. Six different themes also emerged from the student data in response to the research question, which include: (1) “How to Work with Technology”: Student Use of Technology, (2) Teacher as a Leader: “She Is a Good Role Model on How to Use Your Laptop,” (3) “It’s a Great Way to Learn”: Life with 1:1 Computing, (4) “It’s like Getting Your Driver’s License”: Student Perspective with 1:1 Computing, (5) “Stressful”: Life Before 1:1 Computing, and (6) "Oh Boy": Social and Technical Obstacles of First Year Laptop Integration. Chapter 4 presents each of these themes in the order of significance in response to each research question.
CHAPTER 4
FINDINGS

Introduction to Research Findings

The purpose of this study was to examine the integration of technology with students with disabilities, particularly the use of one-to-one computing when used in inclusive classrooms. Much of the research conducted on one-to-one computing has been reported using quantitative measures (Dunleavy & Heinecke, 2008; Hembrooke & Gay, 2003; Keengwe, Schnellert, & Mills, 2012; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010); this study took a qualitative approach exploring how one teacher integrated one-to-one computing into the curriculum and how students with disabilities perceived that integration. The data analysis resulted in several themes in response to the research questions:

1. How do teachers integrate one-to-one computing in an inclusive language arts classroom?
2. What do teachers perceive as the learning benefits and barriers of using one-to-one computing in inclusive classrooms?
3. What do students with disabilities perceive as learning benefits and barriers to one-to-one computing?

Three themes emerged in response to the first research question regarding how teachers integrate one-to-one computing. The first theme, based on an analysis of data from teacher interviews (TI), transcripts of classroom activities (TCA), and observational field notes (OFN), was described as "The World is at Their Fingertips": Uses of Technology.
The next two themes, based on an analysis of data from student interviews (SI), transcripts of classroom activities (TCA), and observational field notes (OFN), were "How to Work with Technology": Student Use of Technology and Teacher as a Leader: "She Is a Good Role Model on How to Use Your Laptop."

"The World Is at Their Fingertips": Uses of Technology

The theme that emerged from the teacher data in response to the first research question regarding the integration of one-to-one computing was "The World Is at Their Fingertips": Uses of Technology. This theme emerged from interviews with Kim, transcripts from classroom activities, and observational field notes. These data revealed the integration of one-to-one computing included accessing online resources, utilizing Moodle Learning Management System, and employing software and online assessment options.

Online Resources

Many online resources were integrated into the eighth grade inclusive language arts curriculum. During a classroom observation, Kim said to the class, "I want you to learn a lot of different online tools this year" (TCA, October 2, 2012). Each time Kim's classroom was observed, a new online tool was integrated into her lesson. These resources included accessing websites, Gmail, and Skype. Kim introduced her students to websites such as classtools.net and readwritethink.org. These websites had interactive graphic organizers such as Venn diagrams and story maps the students used to complete the objective for the lesson. Kim also introduced websites such as flashcardmachine.com
and spellingcity.com for students to use as study tools to learn their vocabulary and spelling words.

When the school district implemented one-to-one laptops in fall 2012, all students and teachers were given a Gmail account. With these accounts, students and teachers were able to send e-mail messages to one another and collaborate when working on Google presentations and Google documents. At the beginning of data collection, Kim walked students through the process of sending an email and attaching a document. For one particular assignment, the students watched short video clips and completed an interactive Venn diagram comparing the novel to the video clips. Kim wanted students to email her the Venn diagram when it was completed. In the transcript of classroom activities, Kim explained the process of sending an email and attaching a document to her class:

In addition to sending it as an attachment, in the message section of the email, you are going to answer a question for me. So you are actually handing in two things: you're handing in your Venn diagram and you're sending in the answer to my question. If you have it saved, then you will go to your school Gmail account. You will need to be in 'mail' rather than 'documents.' And to send an email you're going to click on compose. If you start typing 'Kim,' you should see my name. What do I click on next to attach a file? Yes, where it says 'attach a file.' Now where do I go to find it?

Thank you, in my 'language arts' folder. I'm going to click on my name because that's what is going to bring up my folders. I'm going to click on my 'language arts' folder and find 'War Horse' document. In the subject line of the email, please write 'War Horse.' You know how I hate it when my email gets clogged up with 60 emails. Type in 'War Horse' for the subject line because I'm just going to make a folder in my email so I can drag all these assignments in there quickly. Down here in the message part of the email, I want you to type your answer to this question: How did the director's decisions make the movie different from the book? (TCA, October 2, 2012).
Not only was email used in their Google accounts, but Kim also provided opportunities for students to work collaboratively on projects by using Google presentations and Google documents. Observational field notes recorded how Tom and Mitch were partnered with one classmate to complete a task using Google presentation. Kim explained for the task to be completed, students needed to write 10 clues about the school's location for the Mystery Skype. Five clues needed to be found from book resources Kim provided and the other five clues could be found online using search engines such as Google, Firefox, and Internet Explorer. The students chose to work beside their partners or at their own desk to complete the task. Kim's inclusion of Gmail was evident throughout the data collection.

Another application Kim introduced was Skype. Skype allows users to communicate with others from around the world through a computer. Kim had to set up a Skype account and have access to a microphone and webcam for her computer. This equipment allowed her and her students to talk to and see the students on the computer screen. This online tool was new to many students. Kim was informed about an opportunity for her class to partner with a class from a different state and participate in a Mystery Skype. Kim prepared her students for the Skype by writing clues about their school's location, inviting students to choose roles such as blogger, location finder using Google Earth, spokesperson, photographer, and other roles for which students were responsible during the Skype, speaking into the microphone, and practicing Skype from different rooms in the building. Kim told the students:

Don't be surprised if they ask you to repeat your clues. Sometimes, depending on the Skype connection, it's easier to understand than other times. Also, if you don't
hold the microphone by your mouth the whole time, they might hear only part of what you said. Just be prepared if they ask you to repeat the clue (TCA, October 29, 2012).

Through the Mystery Skype, students were able to connect and meet another class from a different state. Kim explained how she also wants to integrate a standards based I search unit:

In the past I have done a traditional research paper with students because there are so many skills within a unit of a research paper that are important for students at this grade level to have experience with. The I search paper still incorporates those types of research skills, but what I hope to gain from my students in switching the format for our research unit is that they will conduct a personal interview, which might be Skype, might be an online discussion, might be as simple as a questionnaire they create in email, but to get a first person source incorporated in their research. To allow a broader range of options for the topics of their research so that students are choosing something they are definitely interested in. And then it comes back to the reflection piece: a big part of an I search versus a traditional paper is the addition of a reflection where students are writing about their process and also writing about their discoveries and the personal impact it has on them (TI, October 22, 2012).

The integration of a standards based I search would allow students to generalize the technological skills they previously learned in language arts to a real life context. Skype was integrated into Kim's curriculum so students would know how to use this online application for other assignments and outside of school. I search and Skype were authentic activities that allowed students to use technology applications to research and solve real-world problems meaningful to them (see Table 4).

Kim also described another online resource, Wiggio, a collaborative tool. Wiggio is an online website that allows students to manage different groups of which they are members. Wiggio allows group members to send mass text or voicemail messages, keep shared calendars displaying meeting dates and deadlines, store files in a central folder, set
up conferences calls, and hold online meetings. Kim assigned students in a *Wiggio* groups for literature circles:

It's designed to be a group place online. It doesn't really fall within *Moodle* [online learning management system used to create online classes, assignments, modules, quizzes, and forums], Edmodo [free online learning management system designed specifically for teachers and students], and the other learning management systems. When I look at the website, it's commonly used by educators and commonly used in business where employees need to be working in groups. The reason I'm exploring it instead of using *Moodle* is because students can upload websites that are relevant that other students can use. They can upload a wide variety of different kinds of things they have created. If they are using an online tool to do a character analysis, they could upload a link to that site they created for that character analysis. If they are working within a Google doc or Word doc, they can upload that to the group page because with literature circles, each of the students will have something they need to bring to the group. I'm hoping this will be a tool that can be the gathering spot, plus the communication piece because there's a calendar feature, a messaging feature, and it provides emails that list the activity within the group account. So if I want to use it to post comments or assignments, which will go out in emails to members of that group. Student members of the group are posting their work; I will receive that message to know that that's there (TI, November 21, 2012).

Observational field notes illustrated how Kim introduced this new online tool to her class. Kim showed the students, through examples she had created, how they could send voice messages, video messages, and upload a video to their *Wiggio* groups. Kim also showed students an introductory video explaining the purpose and uses of *Wiggio*. *Wiggio* was used as an activity to create a collaborative, active learning environment according to the Technology Integration Matrix (Table 4).

Besides the online resources explained above, Kim integrated online stories, eBooks, and video clips to enhance her instruction. In conjunction with *Moodle*, Kim explored using *Naiku*, an online tool for teachers to administer quizzes. Kim was observed finding different ways to assess students so they didn't always do things
through *Moodle Learning Management System*. While she was using *Moodle* for her primary learning management system to assess students, she was trying different systems. This kept students from getting bored by only using *Moodle* but also allowed Kim to examine and test new systems that may better address students' needs.

Kim used these online resources to provide additional supports for students with disabilities in her inclusive language arts class. Online resources provided diverse options for students with disabilities to exhibit autonomous behavior while interacting with their learning environment. She specifically used these online resources to differentiate according to the students' interests, learning styles, and abilities. Kim's ability to differentiate using online resources promoted inclusive placements and provided access to the general education curriculum for students with disabilities.

Websites, Gmail, and *Skype* were online resources whose integration was observed throughout the data collection. In addition to these online resources, Kim further integrated online supports such as *Moodle*.

*Moodle*

Kim had chosen and was excited about using *Moodle* as the learning management system in her classroom. Through this system, students were able to access PowerPoints, videos, and handouts Kim uploaded. Kim also created discussion forums within the system that students were required to read and respond to peers' posts. *Moodle* was also used to administer online tests. Kim described how *Moodle* allowed her to differentiate to meet her students' needs:

Because I can, once I get going, differentiate within *Moodle* by creating groups for my students and giving students different lessons and different assignments,
but I just don't have time to do everything I would like to be able to do there yet. One of the things that is a great feature in Moodle is if students are doing an exercise or a quiz, I can give them immediate feedback that is tailored to their answer. And that is so efficient; it individualizes learning and it puts the student in charge. So there are some exciting things (TI, September 27, 2012).

Kim elaborated on how she could design instruction through the Moodle Learning Management System to specifically help students with special needs in her classroom:

I think that is a great power of technology that will be able to help students with disabilities. I think that the access outside of the classroom, because when my students do something in Moodle, they can look it over when they are outside of the classroom. I set most of my practices so they can do them multiple times if they choose to. So they can go back and they can review things if they choose to. I think also that you can hit different learning styles by using video clips and by doing different types of exercises, by having class discussion within Moodle, because some of the students with disabilities have gotten very shy about speaking in front of a group. But there doesn't seem, the students this age, to be that pressure associated with a discussion group online, everyone contributes and everyone responds to other students, and it just seems like some of the students who are quiet in class are more active in Moodle (TI, September 27, 2012).

Observational field notes captured how Kim used Moodle to upload language arts content for students to review. One specific example of this was an interactive PowerPoint about conjunctions and compound sentences that Kim uploaded to Moodle. Students read the information in the PowerPoint presentation to assist them in answering questions about the content. A few days later, Kim created an online quiz in Moodle to assess students' understanding of conjunctions and compound sentences.

Kim integrated Moodle to create groups, differentiate her lessons and assignments, change the types of activities she used, create online quizzes, and upload review PowerPoints based on readiness students self-selected. For example, Kim created three PowerPoints based on readiness regarding kinds of sentences and end punctuation. The first PowerPoint was an introduction to periods and other end marks for students who
needed the basics. The second PowerPoint went into more detail regarding other times periods may be used instead of just at the end of a sentence. The third PowerPoint was an interactive review that asked students questions and they had to click on the correct answer. Students received immediate feedback if they answered the question correctly. Each time she used Moodle, Kim modeled each step and showed the students where to find the information. Moodle was used multiple times throughout the period of the study as evidenced by observational field notes and transcripts of classroom activities. Moodle was used as Kim's primary learning management system to create active, collaborative, and goal directed learning activities for her students in an online environment (see Table 4).

Kim used Moodle to provide online supports for students with disabilities in her inclusive language arts class. Kim differentiated her instruction within Moodle to accommodate students' learning styles and readiness levels. By differentiating through this online support, stigmas were not apparent; all students were working on a task appropriate for their instructional levels. Kim's ability to differentiate using Moodle promoted inclusive placements and provided access to the general education curriculum for students with disabilities.

Software/Online Assessments

Software programs and online assessments were also integrated into Kim's instruction. The school district paid for the STudent Achievement in Reading (STAR) program, Measure of Academic Progress (MAPs) DesCartes assessment, and a subscription to MyAccess. The district purchased and installed HyperStudio on the
school's computers. Kim identified HyperStudio and MyAccess as software programs and MAPs and STAR Reading as online assessments.

All students had HyperStudio installed on their laptops to complete a project Kim created. HyperStudio is a multimedia authoring system similar to PowerPoint. Students chose a Native American folktale to read and created a HyperStudio presentation summarizing the moral of the story. Kim provided students a storyboard to draw their rough drafts before creating their final drafts in HyperStudio to present to the class. Students were observed working several days in class on these presentations, including the final day of student presentations. According to the Technology Integration Matrix (Table 4), HyperStudio was used as an active and constructive activity because students were actively engaged in the technology to build their understanding.

MyAccess was another software program for which the school purchased a subscription. Students wrote and submitted writing samples in MyAccess. After students submitted their writing samples, the MyAccess program analyzed students' writing for spelling, grammar, and punctuation errors. MyAccess cannot provide feedback on organizational and structural writing elements; the teacher has to read the writing sample to provide that kind of feedback. Kim described MyAccess as: "a computer based system where students do their writing in MyAccess and they get immediate feedback when they submit their writing" (TI, September 27, 2012). Kim said the school was in its second year using the program and the writing traits studied in Kim's language arts class were aligned with the program. Kim explained how she differentiates instruction:

MyAccess is one example because when students get feedback, I can set the program to give them feedback that is based on their vocabulary. So that they can
get feedback adjusted for their level and where they are. Now the computer does
all that, I don’t have to do it all. I just have to choose that setting, but that’s so
exciting that option exists and that opportunity is there for my students (TI,
September 27, 2012).

Students were observed using MyAccess for one writing assignment involving family
traditions. MyAccess was one software program that gave Kim information about her
students' writing skills. This activity is goal directed according to the Technology
Integration Matrix (Table 4) because the technology permitted students to reflect on how
to improve their writing.

MAPs was an online assessment Kim used to determine the skill levels of her
students in math, reading, and language arts. In addition, the teachers have access to the
data reporting site called "DesCartes," from which teachers can retrieve students' MAP
data. After students take this assessment, Kim can "go back to the MAPs scores, which is
technology again, and look at the DesCartes to see which skills certain students are ready
for and then tailor lessons within Moodle to meet the needs of the different students" (TI,
September 27, 2012). MAPs information was used as a tool for Kim to better differentiate
instruction based on students' skill levels.

The STAR Reading program was an online assessment the school purchased to
assist teachers in determining students' instructional reading levels. The new program
provided more diagnostic information.

The results I get from the new STAR Reading program do the work of the
diagnostic part for me because they tell me what the student's instructional levels
are and what the skills are students need to work on to rise to the level of their
peers (TI, September 27, 2012).
Kim pulled out the report she generated from Mitch's information to show the new STAR Reading program. Kim stated the program "shows Mitch's percent of mastery in each of the subskills areas. The company actually got permission from the state of Iowa to tie it to the Iowa Core" (TCA, October 29, 2012). Kim generated reports on students with whom she had concerns or ones for whom she was trying to target appropriate skills.

HyperStudio, MyAccess, MAPs, and STAR Reading were software programs or online assessments. Data gathered from interviews with Kim, transcripts of classroom activities, and observational field notes indicated a high level of integration of these into Kim's curriculum.

Online resources, such as websites, Gmail, and Skype, online Moodle support, software programs, and online assessments were incorporated by Kim into her language arts classroom. This integration allowed students to have the world at their fingertips and enabled Kim to differentiate instruction for students with disabilities by creating lessons at their instructional levels.

Two additional themes that emerged in response to the first research question were based on data analyzed by student interviews (SI), transcripts of classroom activities (TCA), and observational field notes (OFN). These two themes were "How to Work with Technology": Student Use of Technology and Teacher as a Leader: "She is a Good Role Model on How to Use Your Laptop."

"How to Work with Technology": Student Use of Technology

When students were asked how their teacher integrated technology into their eighth grade inclusive language arts class, the first theme that emerged was "How to
Work with Technology": Student Use of Technology. Student interviews with Mitch and Tom, transcripts from classroom activities, and observational field notes revealed a variety of online classroom supports and student-selected uses of technology.

Classroom Supports

In their interviews, Tom and Mitch described many of the same online resources as Kim. These resources included accessing websites, Gmail, Skype, and Moodle. Mitch seemed to be more tech savvy, which allowed him to figure out the online applications quicker and with less assistance than Tom. When Kim introduced Flashcardmachine.com to the students, Mitch was able to create a username and password with no difficulties, whereas Tom needed assistance as to what he needed to do. Once Mitch created an account, he easily was able to follow Kim's directions to start a new set of vocabulary cards. Tom required some assistance from the paraprofessional. Tom described the online resources he used for different classes:

I use Google mostly for social studies to look things up. In math we are doing Cognitive Tutor and Kahn academy for that. And then language we are starting HyperStudio today but we have been using Google docs, Gmail, and Firefox. I had to use Google Sketch Up for my shop class this year to make a picture of our car out of a block of wood (SI, September 27, 2012).

Tom was observed utilizing these online resources during language arts as well as classstool.net, readwritethink.org, spellingcity.com, and Google presentations.

Mitch explained how he used some of these online classroom supports at home: "I go home and write a random passage of something and then just delete it. I would go on the Internet and go to Cognitive Tutor and do some math problems on there" (SI, October 24, 2012). Mitch listed the same online resources Tom listed and described how the
content teachers integrated those resources into their instruction. These online resources provided an active learning environment for Tom and Mitch. The websites used actively engaged Tom and Mitch rather than them passively receiving information from the technology.

Tom and Mitch were also observed working on a Google presentation with a partner. Tom chose not to sit with his partner to complete the task, whereas Mitch sat alongside his partner and worked together on their portion of the Google presentation. When Tom spoke about Google docs in his interview, he stated:

If you need to do an assignment and you share this document in Google docs, then you can let your friend, if you're typing up a story or something, and you share it with a friend because they need to know where you are on it if you are working with them. They can also type as you are and put in things on the story (SI, October 26, 2012).

Classroom observations revealed Tom enjoyed working with a partner to complete a task without sitting or conversing with him/her. According to the Technology Integration Matrix, Google docs and presentations created an authentic and collaborative learning environment for Tom and Mitch. They were able to use the technology to collaborate with their peers to solve real-world problems meaningful to them.

*Skype* was also integrated throughout the language arts curriculum. During one classroom observation, the language arts class used *Skype* to collaborate with another school in the United States. Mitch's role throughout the Mystery *Skype* was a mapper. He downloaded Google Earth to his computer and used the clues the mystery school provided to try to determine its location. Another website, *todaysmeet.com*, was used as a back channel for the eighth graders to communicate their guesses back and forth without
the mystery school hearing them through Skype. Tom was a mystery solver, which required him to use clues to solve where the mystery class's state, town, and school were located. The Mystery Skype provided students multiple opportunities to use technology to present clues to the other school and guess where the mystery school was located. After each school correctly identified the other's state, town, and school, each student introduced him/herself. Tom and Mitch both took a turn to step in front of the camera, speak into the microphone, and introduce themselves. Skype was an authentic activity that allowed Tom and Mitch to use technology applications to determine where the Mystery Skype was located.

Another classroom support the students identified was Moodle. Both students appreciated how the Moodle Learning Management System facilitated their learning and ability to work at their own pace, and take their time to complete quizzes. Tom stated, "We can talk to the teacher if we need to, send an assignment, and we can also work with students if we need to if we're partnered on something and we aren't in the same place at the same time" (SI, October 26, 2012). Tom reported why he liked to complete quizzes and lessons through Moodle: "I like taking my time on the tests because I want a good score" (SI, October 26, 2012). Mitch explained why he liked the Moodle Learning Management System:

You don't have as much worksheets, but you can also take your own pace at it instead of having like a big group trying to read through it on a piece of paper. You can take your own time on the quiz instead of having a certain amount of time. You can work on it while you are at home or while you have a DST [directed study time] (SI, October 24, 2012).
Classroom observations revealed both Tom and Mitch were able to work independently on quizzes and assignments within Moodle. Mitch stayed on task and completed the assignment at about the same time as his nondisabled peers. Tom, on the other hand, was more easily distracted and took an extended amount of time to complete online work. Most days of observation, Tom did not complete his work in the 80-minute language arts block, whereas his peers did. Both students felt comfortable asking the paraprofessional or Kim questions to assist them in completing the assignment. Tom and Mitch responded favorably to the opportunity to work at their own pace within Moodle. The utilization of Moodle by Tom and Mitch was observed frequently. According to the Technology Integration Matrix (Table 4), Moodle Learning Management System was a goal directed activity that allowed Tom and Mitch to monitor and evaluate their progress on tasks.

Many online classroom supports were utilized by the students throughout the nine-week study. Classroom supports such as Google, Gmail, Internet Explorer, and flashcardmachine.com were used more frequently than others. The integration of technology was observed each day as students used their laptops every day in language arts.

**Student-Selected Use of Technology at Home and at School**

Some applications were student-selected rather than teacher-directed in the classroom. Tom and Mitch explained the types of technology they have at home and how they use those technologies. Since Tom did not have Internet at home, he played handheld games such as PlayStation Portable (PsP) or Nintendo DS (Dual Screen or Developer's System), or listened to his sister's iPod. Mitch, on the other hand, did have
Internet access at home and liked to check Facebook and play Internet games such as *Balloon Tired Defense*.

Both boys stated they like using technology to help them spellcheck, review, and revise their work when they are at school. Tom stated, "I just like going to spellcheck to make sure I spelled it right" (SI, October 26, 2012). In a later interview, Tom reiterated the fact, "In a computer report, you have to type it up and then send it to the teacher. You have to spellcheck, review, and then revise or something like that so it [using the laptop] makes it easier on you" (SI, November 26, 2012). Tom wanted to do well in school, so he used the spellcheck tool to check his written work in hopes of earning a better grade.

Observations revealed how Tom and Mitch used their laptops to take notes in language arts. Kim typed and projected her notes on the large screen as she lectured. The class was expected to copy the notes she wrote in a Word document. Mitch was a faster typist than Tom and was able to answer Kim's discussion questions as he typed his notes. Tom's typing skills were not as advanced, which affected the time it took him to type the notes in his Word document.

Technology was integrated into the language arts instruction in many different ways. Both participants shared how they used technology at home and school. Teacher-directed uses of technology during school included online resources, such as websites, Gmail, *Skype*, and *Moodle*. Tom and Mitch also selected and used different types of technology at home. These technologies included handheld games, an iPod, Internet games, and Facebook. Tom and Mitch knew how to use a variety of self-selected and teacher-directed technology applications.
Teacher as a Leader: "She Is a Good Role Model on How to Use Your Laptop"

The second theme that emerged from the student data in response to the integration of one-to-one computing was Teacher as a Leader: "She Is a Good Role Model on How to Use Your Laptop." These data revealed Kim guided the students' integration through modeling. She further illustrated to these students how technology could be integrated to submit class assignments.

Teacher Modeling

Data revealed that Kim modeled each step when introducing and reinforcing the use of technology. When asked about what he liked best about Kim's use of technology, Tom quoted her by saying:

Sometimes she'll ask us if we've done any of this stuff and sometimes when we say no, she'll be like, "Yeah, I'm the first one to teach you guys this stuff" and it's kind of cool to learn how to use it after you've seen how it's done (SI, November 26, 2012).

Mitch responded:

She'll write it [URL] on the whiteboard so you can type it in or if she has something down for the huge screen that rolls down for her computer to connect to and show you where to be. Then she will spell out the words and the slashes and the .org or .com (SI, November 28, 2012).

Both participants enjoyed learning new technology applications and appreciated how Kim took the time to model each step. Kim introduced her students to many new applications and integrated them effectively into that day's lesson. When Kim first introduced new applications, she would not allow her students on their computers; she would say, "I want hands off the computer" (TCA, October 2, 2012). After she modeled everything for the students, she would say, "Open your computers and do this with me as
I go through the steps" (TCA, October 2, 2012). Mitch reported: "It [Kim modeling] makes me feel a whole lot better that she's taking care of how to use a computer and how to show us where we need to be. If someone is behind, she tries to help that student" (SI, October 24, 2012).

Kim was viewed by the students as a role model for technology integration. She modeled how they could use their laptops for academic purposes and introduced the students to new technological applications.

**Submitting Assignments**

Kim also illustrated to her students how technology could be integrated to submit classroom assignments. Tom and Mitch both stated that Kim emailed assignments to the students and expected them to submit assignments electronically. Tom explained Kim would tell the students she sent them an email; this was also witnessed during classroom observations. He later provided an example:

One of them was Solly, it was a Native American Indian review paper that you had to type vocabulary words on it that you heard from the story in our book. Right now I'm working on a family traditions paper in MyAccess she sent us and pretty much right now I'm talking about how our family goes on vacation every summer (SI, October 26, 2012).

Tom described how he had many assignments last year that did not get done or turned in. He stated, "The pressure has been taken off" (SI, November 26, 2012). He later clarified:

Because the computer helps with some of the assignments and books help with other parts of it. Sometimes most of the assignments are sent on the computer by the teachers instead of in the books, which helps because then you look up things that you need to know to put on the assignment (SI, November 26, 2012).

Mitch didn't have as strong as feelings as Tom did about handing in his assignments electronically. Mitch stated his preference for submitting his work: "It depends on the
subject and what it is. If it's math, I'll probably hand it in physically. If it's language arts, probably on the computer" (SI, November 28, 2012).

Classroom observations found Kim reminding students they do not have printing rights. The district did not permit printers to be installed on students' laptops; therefore, students could not print assignments or information from their laptops to a school's printer. Because of this, whenever Kim had students complete an interactive Venn diagram, online worksheet, or an assignment in Moodle, students had to submit their assignments electronically. Depending on the assignment task, Kim had to figure out different ways for students to save their work so they were able to attach it to an email to turn it in. The students seemed very responsive to the multiple ways to save and submit their work in Kim's language arts class.

In summary, three themes emerged in response to the first research question. The teacher theme described the many ways Kim integrated technology into her inclusive language arts class that allowed students to have the world at their fingertips. The two student themes elaborated on online classroom supports and how their teacher modeled the integration of technology.

The second research question attempted to address the teacher's perceived learning benefits and barriers of using one-to-one computing. Four themes emerged based on the analysis of data from teacher interviews (TI), transcripts of classroom activities (TCA), and observational field notes (OFN). These themes were (1) Motivation: "The Power of Choice," (2) "Leveling the Playing Field": Students with Disabilities, (3) "This Is Still Very New": A Teacher's Perspective on Technology Integration, and (4) "It
"Breaks My Heart": The Underutilization of Technology. Each of these themes illustrated Kim's perceived learning benefits and barriers of using one-to-one computing in her inclusive language arts classroom.

Motivation: "The Power of Choice"

The first theme regarding teacher perception of learning benefits and barriers was Motivation: "The Power of Choice." This theme was analyzed using data from interviews with Kim, transcripts of classroom activities, and observational field notes. Within this theme, Kim described several benefits to the implementation of laptops, which included providing immediate feedback, pacing students, connecting to the Internet, and increasing student engagement. An additional benefit was how technology assisted in integrating 21st century skills in the curriculum.

Providing Immediate Feedback

Kim discussed immediate feedback multiple times throughout her three interviews and was observed providing immediate feedback to her students. One of the reasons Kim liked to use Moodle was "if students are doing an exercise or a quiz, I can give them immediate feedback that is tailored to their answer" (TI, September 27, 2012). Kim also stated that MyAccess supplies students with immediate feedback regarding their writing; however, the feedback is the kind "a machine can give so you still need a human element there" (TI, October 22, 2012). She added:

I think that the style of learning is new enough for them that they didn’t have that preconceived expectation, but I think that they really like it [immediate feedback] and that if it were taken away they would demand to have it back. And I think that it’s such an aid in learning (TI, October 22, 2012).
Kim was observed providing this feedback while administering a spelling pretest. After
Kim said the word and gave students time to spell it, she orally spelled the word correctly
and showed the correct spelling on the screen. She explained:

When I studied how to teach spelling, one of the things a professor mentioned that
had a huge impact on what I do in the classroom was that if students immediately
correct a word right after they have first written it, the wrong answer doesn’t have
time to imprint on their brain. And I think that relates to that. If they can correct
misconceptions immediately, rather than giving their old way, their incorrect way
to become routine, it’s easier to break out of those old habits (TI, October 22,
2012).

Kim stated that such a process may not be efficient but was better for the students.
Observational notes showed it took about 20 minutes to administer a spelling pretest of
20 words.

Kim applied this philosophy to other learning opportunities when students use
their laptops. When Kim set up new modules in Moodle students were given immediate
feedback after practicing a skill so they knew if they answered the question correctly or
what they did wrong so they could change it next time. Kim was also observed constantly
walking around checking on students' progress while they were working on their laptops.
She tried offering specific feedback to individual students to avoid misunderstandings
and enhance learning.

Pacing Students

An additional benefit of using one-to-one computing was Kim's ability to provide
students opportunities to work at their own pace. Kim reported she gave students a self-
evaluation to prepare for parent-teacher conferences: "Based on the self-evaluations that I
mentioned earlier, I think for the majority of students, I don’t know if it’s so much the
delivery as they can work at their own pace" (TI, October 22, 2012). Kim also explained to students what it meant by working at your own pace during one classroom observation:

When we make that shift to a 1:1 laptop in our schools that means we can do things a little differently. We talked about at the beginning of the school year that spending time in that green language book is not our favorite way to spend our class time. When we move to the world of online learning, one thing that is really neat is that you can go at your own pace. When we're working together in the green book and I'm leading the discussion, some of you already know that information and its review and you'd like to go faster. Some of you have questions and would like look back over the information again just to make sure that you understand correctly but we are already moving on in class. So, today, our goal with learning about kinds of sentences and end punctuation is for each of you to be able to move at the pace that works best for you so you are in charge of your learning today. That's who should be in charge of your learning. YOU! So you're going to choose the pace that works best for your learning to cover the information to learn the information that's in today's lesson (TCA, October 4, 2012).

When given time in class to work, many students worked well independently knowing they could work at their own pace.

**Connecting to the Internet**

Another benefit was connectivity. All students have Internet access on their laptops at school. Kim showed them how to save websites into PDFs so if a student, like Tom, didn’t have Internet access at home, he/she could still have read and looked up information on that website. Kim stated, "Most of the work they are going to do is done in school; therefore, they have the connectivity here so it's not going to be such an issue for them" (TI, November 21, 2012). Tom and Mitch both reaffirmed they had time in class to complete most of their work, and their homework every night was to read.
Increasing Student Engagement

Kim provided students with choices daily, which also motivated and engaged students. On several occasions, the choice was simply whether or not students wanted to hand write an assignment or type and hand it in electronically. Since the beginning of the year, Kim said:

There's an increasing number of students who would choose to write electronically than there had been previously. I think that in some of my sections 100% would choose to type. In some of my sections, it may be closer to 90%, but out of 20, that would only be two students (TI, November 21, 2012).

Kim also explained how she used an online tool to ask students questions. As students chose a response, a graph displayed the percentage of students who chose each response. "Student engagement rises when you can do things like that with technology," Kim stated (TI, September 27, 2012).

Kim gave students other choices as well. A common choice for students was to work independently or with a partner. For one particular lesson, students chose the module from which they wanted to learn the punctuation content; each module was differentiated by readiness. Students also chose which role they would have in their Mystery Skype. Kim allowed students to choose how they would complete a task. Kim said, "It just makes the task so much easier to get started on if they have a choice about how to approach it" (TI, October 22, 2012). Students were observed quickly getting started on the task and staying on task when Kim gave them a choice. Kim stated:

I think they like choice in general. There is great power in choice. I think even when I know ahead of time that it's a clear cut choice, if I just throw out, it's your choice; it still works as a motivator. They very quickly go, "I choose this" and get started - it's magic (TI, November 21, 2012).
One-to-one computing allowed Kim to offer her students more choices in how they completed the task, where they could find the information, and how she presented the information to her students.

Immediate feedback, providing an opportunity for students to move at their own pace, connectivity to the Internet at school, and student engagement were seen as benefits to one-to-one computing. These benefits may have also contributed to students' increased learning of the language arts content. Another significant benefit to one-to-one computing was the ease of integrating 21st century skills into the curriculum.

21st Century Skills

An increased emphasis is placed upon teachers to teach students the 21st century skills to prepare students to be contributing members of society. So much emphasis is placed on these skills they have become a part of the Iowa Core Essential Concepts and Skills. Kim stated, "There's a lot of teaching going on this year that's more than just content area teaching because kids need to develop those skills to use the computers before they can get to the content area" (TI, September 27, 2012). Such skills include critical thinking and problem solving, collaboration, adaptability, entrepreneurialism, oral and written communication, accessing and analyzing information, and curiosity and imagination.

In a short two month span, students quickly picked up on the necessary skills required to use their laptops. Kim stated that one-to-one computing "makes it easier for me to design lessons that will appeal to students while targeting some of those particular skills. It will be the hook" (TI, November 21, 2012). She elaborated:
It's going to be much easier for me and other teachers to encourage those types of skills through the use of technology. The Skype was one example where they were practicing their thinking skills when they were researching for facts; the whole idea starting with clues that would pinpoint Iowa and narrowing it down to our middle school in our town, regarded some critical thinking in order to be able to put those clues in the correct order. The evaluation and speaking skills were very strong through the Skype. I think the evaluation skills helping each other figure out "Am I using the correct tone? Am I speaking loud enough? Am I doing these sorts of things?" (TI, November 21, 2012).

Skype was one example of something the students had already done as noted throughout classroom observations. Kim explained she was planning on teaching an I search rather than a traditional research paper so that students could conduct personal interviews. The goal of an I search is to get a first-person source incorporated in their research. This could be accomplished through Skype, an online discussion, or a questionnaire sent out through e-mail. Kim said that a big part of an I search versus a traditional paper was the addition of a reflection in which students write about their process, discoveries, and the personal impact it had on them. Kim explained what 21st century skills students would apply during an I search:

They are going to need strong communication skills to work with someone who will be a first-person source, so I think communication will be a huge skill that will need to be worked on a lot. Being able to use and integrate technology to do interviews will be a skill they'll need to do a lot of problem solving to figure out how to make things work for them. From choosing their topic to figuring out what type of person would be a reliable and appropriate source for their topic and then after figuring out what type of person that would be, what individual would be a good source. Even the self-confidence to be able to approach someone to ask them if they would be willing to conduct an interview will be huge growth for my students. The critical thinking that will be required for them to then, once they have their research completed, be able to integrate it and reflect upon it (TI, November 21, 2012).
According to the Technology Integration Matrix (Table 4), Skype and an I search were integrated as authentic activities. Both activities were also examples of how Kim integrated technology using 21st century skills to teach students.

Many 21st century skills were observed being enhanced through the integration of technology. Kim provided opportunities for students to think critically and problem solve almost every day of observation. Kim stated, "Critical thinking: I really like some of the online tools, even if they are simple tools that we have done on paper before. Students are more motivated to use those tools when they can use them with technology" (TI, September 27, 2012). When students were having difficulties with their laptops, a common question Kim asked was, "How can you solve your problem?" (TCA, November 15, 2012). As the year went on and students had their laptops longer, students troubleshooted independently or collaboratively before they asked for Kim's assistance.

Kim also used an online pairing tool called Fruit Finder to randomly assign pairs of students to work together. Kim stated:

The group you are observing, maybe it's good you haven't observed too much group work, they need training in how to work in pairs and groups, and we will be working a lot with that between now and Christmas. Because I watched them last week, and they were doing a character dialogue, we were studying how to punctuate a dialogue so each person was supposed to take the role of one of the characters from the story and then they chose the scenario to create a conversation about. I watched one group, one pair, where one student did all the work and the other partner just kind of sat there bewildered not knowing what to do because his partner wasn't talking to him and allowing him to have any input. And then I had another pair who were bickering in the corner about who was going to do what and didn't get anything done. This group does not know how to work cooperatively and that's one of our district goals so it's beyond the technology issue when these are the things going on. And with that particular group and the personalities that are there, it's a major issue (TI, November 21, 2012).
This lack of collaboration was evident on two separate occasions. The first time Kim had to separate Tom and his partner because they could not stay on task. The second time Kim had to speak to Tom and his partner, which was a different peer than the first instance, about her expectations, "I expect you two to be talking together and not just working independently" (OFN, November 26, 2012). Tom and his partner did do a better job collaborating after Kim talked to them. She explained:

Some of the study and research I have read that deals with authentic group work has the focus that when students are assigned to work in groups each member of the group has an individual role. In order for the group to accomplish what the group needs to have completed, each member needs to do their part. They can work cooperatively and ask questions of group members to help figure out how to do their part to evaluate their parts yet each student has a responsibility (TI, November 21, 2012).

Kim wanted to teach students how to collaboratively work together. Wiggio, an online collaborative tool, was introduced to students as a means to accomplish this goal of Kim's.

Oral and written communication was another 21st century skill Kim reinforced with her students. During the Skype experience, Kim told students multiple times "look into the camera" and "get in front of the camera before you start; speak slowly and distinctly" (TCA, October 29, 2012). Kim also stressed the importance of written communication by guiding students through a daily oral language (DOL) passage each day so they learned grammar rules and sentence structure. Kim expected students to apply those rules when they submitted written work.

Kim also designed a lesson to give students an opportunity to access and analyze information. Students were given several website addresses and a poem about Paul
Revere. Kim reminded students what a primary source document was and how they would use such a document for this assignment. She partnered students to analyze the poem and websites she provided.

Kim also designed a HyperStudio project that allowed students to demonstrate their curiosity and imagination. Students retold a Native American folktale using their imagination to recreate the story. Students chose what Native American folktale they wanted to learn more about, read, and present to the class. Students were able to interpret the moral of each folktale.

Twenty-first century skills not observed were adaptability and entrepreneurialism. This aligns with what Kim said in a third round interview, "You talk about entrepreneurialism and things being more student driven. Those are two areas that I really need to make more advances in student opportunities" (TI, November 21, 2012). When Kim did incorporate 21st century skills into her lesson, she allowed students to choose between options she had created. Kim was observed providing students opportunities to demonstrate several 21st century skills while using their laptops.

The second teacher theme that emerged in response to the second research question was "Leveling the Playing Field": Students with Disabilities. The teacher data that revealed this particular theme were analyses of interviews with Kim, transcripts from classroom activities, and observational field notes.

"Leveling the Playing Field": Students with Disabilities

The primary focus of this study was how technology could affect the performance of students with disabilities in an inclusive classroom. This theme addressed the learning
benefits for students with disabilities such as increased access, social benefits, and ability
to practice the content at their level.

Access

One-to-one computing promoted inclusive placements for students with disabilities and increased access to instructional technology. Tom and Mitch received their language arts instruction in the general education classroom and had a paraprofessional available in the room for extra assistance when it was needed. Kim commented on the relationship between instructional technology and the need to promote inclusive placements for students with disabilities and access to the general curriculum:

What comes to mind immediately is simply that being a 1:1 school we're leveling the playing the field by providing machines for students. If we were not a 1:1 school I think it would be a bigger concern, especially if students were expected to do work outside class that required electronic devices. I don't feel like it's an issue because every student has a laptop. I don't feel in my particular setting, it's a problem: I guess that's looking at it from the point of view of access (TI, November 21, 2012).

In Kim's view, the requirements of the law were not a great concern since her district received one-to-one laptops. Kim provided accommodations for Mitch and Tom that were stated in their IEPs. If she felt something else needed to be done, she consulted the paraprofessional who was in her room or the special education teacher. Mitch and Tom had access to and were learning the general education language arts curriculum. Kim said, "I think the access outside the classroom is important. When my students do something in Moodle, they can look it over when they are outside the classroom" (TI, September 27, 2012). Kim integrated an online tool that allowed Tom and Mitch to have access to the lesson outside the 80-minute class time. By having one-to-one laptops
available, Kim was better able to differentiate her instruction and provide her students access to the general education curriculum. Inclusive placements for Tom and Mitch increased their access to the general education curriculum and increased social benefits.

Social Benefit

Through interviews and classroom observations, several social benefits for students with disabilities were evident in Kim's inclusive language arts class. Some of the benefits included Tom and Mitch's participation and contribution to group work by incorporating their own ideas, constructing their own knowledge, and assisting peers.

Kim commented:

The social benefit is everyone has the same tool; there’s no stigma because "this person has better equipment than I have." Another social plus would be the fact that students are more, or I should say less, inhibited within an online discussion: everyone is participating or in any type of activity where they are providing their input online. Everyone participates; everyone is involved, so that is a social plus. I think they step outside a stigma where they feel that they are isolated away from a group. Plus, the rest of us have great benefits because we gain understanding, compassion, and sometimes it’s those students with disabilities who understand a whole different point of view than the rest of us do. And we gain so much from them. I think the skills, the confidence, and just knowing they are exposed to the same things as their peers, builds confidence for them (TI, September 27, 2012).

When students with disabilities were first integrated in her language arts class, Kim described it as "the world opened up" (TI, September 27, 2012). Classroom observations revealed that Tom and Mitch were not secluded from their peers. During one observation, Mitch's peers were eager to show him and get his thoughts on their project. Mitch would ask his peers around him questions and worked well independently or collaboratively. Tom, on the other hand, was more reserved. He loved to draw and his peers knew he was exceptional at it. When the class was discussing a new mascot, Tom was the first to get
out his sketch pad to start drawing his vision. During a break, he discussed his ideas and rough drawing with his peers (OFN, November 28, 2012). Tom's confidence in his drawing abilities was reinforced by his peers. Transcripts of classroom activities also confirmed Mitch's and Tom's participation in class discussion during DOL. Each student would raise his hand to contribute daily. Mitch responded to many of Kim's discussion questions during one particular observation (TCA, November 15, 2012). The confidence to participate and contribute to class discussions was evident for Tom and Mitch.

Kim also explained, "There's a lot of give and take between students and everyone is involved, and I don't think that anyone is feeling incapable because they are able to work together with a partner or small group" (TI, October 22, 2012). Kim described how Mitch caught on to technology so quickly and was willing to help his peers. Kim said this about Mitch:

When someone needs help with technology, Mitch is the first in his class to volunteer to help them. When Mitch says he will help, I put that student out of my mind because I know that Mitch will take care of it because he has those skills (TI, November 21, 2012).

One example of this was when Mitch was sitting by another student in the back of the room charging his computer. His peer got behind when they were learning a new computer program and Mitch got him caught up. During one observation, Mitch assisted a new student in the class downloading Google Earth on her laptop for the Mystery Skype. Mitch walked his peer through the process step by step and explained to her what their task would be during the Skype (OFN, November 15, 2012). Kim described the social benefit for Mitch: "For him in particular, he's helping his peers with the technology aspects of the skills. When he is working in groups, it's more of an even tradeoff when his
peers are able to help him with some of the content specific items" (TI, November 21, 2012). Specifically, Mitch required more assistance in writing. His peers helped him with written assignments, particularly, proofreading his work or offering him suggestions for organizing and structuring his thoughts.

The social benefits students with disabilities gained in Kim's inclusive language arts classroom were numerous. Students with disabilities participated and contributed to group work by incorporating their own ideas, constructing their own knowledge and ideas about topics within their group, and assisting their peers. In addition to social benefits, academic benefits were evident.

Practice at Their Level

One-to-one laptops helped Tom and Mitch practice skills and language arts content at their instructional levels. Kim used Moodle to hide how she differentiates so students didn't know what other students were doing. She commented there would be no stigma because everyone would have an assignment on which to work, "I think that is a great power of technology that will be able to help students with disabilities" (TI, September 27, 2012). Kim commented how differentiating the content in Moodle allowed her to meet all her students' needs:

I think for students [with disabilities] it builds confidence if they are receiving instruction and practice at their level and they're finding success. I saw this last week when my students did a self-evaluation for parent-teacher conferences. They were rating their strengths and almost every student felt they were comfortable learning in Moodle. I think that's a reflection of their ability to move at their own pace and to have instruction that's appropriate to their learning levels (TI, October 22, 2012).
Classroom observations revealed the significant amount of time Kim spent preparing for each lesson. She had much of the content outlined in modules posted on Moodle or purposeful online tools selected to accomplish a task. Kim's preparation allowed her more time to move around the room to assist students who were struggling. Kim collaborated with the paraprofessional every day to let her know how to assist the students. The integration of technology supported Kim in her efforts to level the playing field for Tom and Mitch.

Technology promoted inclusive placements through social opportunities for Tom and Mitch and provided access to the general education curriculum. Kim also afforded Tom and Mitch opportunities to practice skills at their instructional levels, which had a positive impact on their learning.

The third teacher theme that emerged in response to the second research question was "This Is Still Very New": A Teacher's Perspective on Technology Integration. The teacher data that revealed this particular theme was analyzed from interviews with Kim, transcripts from classroom activities, and observational field notes.

"This Is Still Very New": A Teacher's Perspective on Technology Integration

This was the first year Kim's school district implemented one-to-one computing. Since the data was collected during the first part of the school year, many barriers were evident in the transition to one-to-one laptops. In addition to the themes associated with benefits of technology integration, several barriers to that integration were observed or reported by Kim. These barriers included lack of time, glitches and lack of technical support, student disorganization, and digital illiteracy.
Time

The most noted barrier to the integration of one-to-one laptops was time. Since one-to-one laptops were so new, Kim said that it took time and effort to make the switch from a traditional paper/pencil setting to almost everything being done on the laptops. She said time was what she struggled with most, "I just don't have time to do everything I would like to be able to do" (TI, September 27, 2012). In Kim's last interview, she explained why time was her biggest barrier on two levels:

Time physically in the classroom with students to do everything I'd really like to be able to do and just personal time beyond my paid hours to be able to do everything I would really like to be able to do. So what I have been really thinking about a lot the past couple weeks, in particular, is determining my learning goals and how those learning goals be best addressed and making sure that when I'm integrating technology, which is one of my huge goals, that I'm doing it because it will help student learning more than an alternate method of teaching. It's fun to learn all the bells and whistles, but we've got to keep that ultimate goal in mind of student learning (TI, November 21, 2012).

Reported in classroom observations were comments Kim made to her students about something "cool" she found online or was working on over the weekend to integrate into a lesson. Kim had a passion to integrate technology into her instruction and wanted to do more than what she was already doing, but lack of time got in her way.

Glitches and Lack of Technical Support

Besides time, computer glitches and lack of technical support were seen as barriers. Since the implementation of one-to-one, the school had not updated its server. Kim stated, "Barriers are when late in the afternoon the Internet gets overloaded and all of a sudden nothing works. That is a huge barrier, and it hasn't happened often this year,
but when it does, it is so frustrating" (TI, September 27, 2012). As more teachers integrate technology throughout the day, this barrier could be more problematic.

Kim also alluded to potential learning barriers for her students. She redesigned her lessons to be in Moodle and integrated online resources, which required her students to be able to read and understand print on a screen versus a textbook. Kim commented:

I am not sure yet if it is a barrier, but something I am very conscious of and very concerned about, especially for my lower ability readers, is are they actually going to take the time to read the information that is in Moodle. Now students can be inattentive in class and they can miss things in class. But it is a little bit different situation, whereas the reading comprehension a barrier because they're reading it on a screen. So I am not sure if that's a barrier yet, but it's something I am very conscious of and will be watching to see (TI, September 27, 2012).

Throughout the study, if Tom or Mitch had difficulties reading the information in Moodle or online, the paraprofessional or Kim would read the material to them.

The major glitch Kim and her students encountered was some students could access files at home they saved at school and other students could not. Kim was observed informally polling her class to determine how many students were still having trouble connecting to the Internet and accessing files at home they had saved at school. Many students were still having troubles with this, and when Kim asked, "Have you been talking to the tech guys or have you given up because you have tried so often?" (TCA, October 15, 2012). Students replied with "given up." Kim described these glitches as very frustrating. She said, "When nearly half of my students can’t access files they’ve saved at school when they are at home, that’s taking away from the power of placing this technology in their hands" (TI, October 22, 2012). Kim went on to describe how she was
"hounding the tech guys" to figure out this problem as it affected so many students. Kim described how the process was intended to work:

Students are supposed to be able to access it from the server when they are at school or from the hard drive of their computer when they are at home. When they restart their computers at school, the files are supposed to be set to automatically sync so the work they have done at home will now be saved to the server. My computer works beautifully that way, but for too many students, there’s a glitch in there (TI, October 22, 2012).

Mitch was the only student participant who had Internet access at home, and he, too, was affected by this problem.

Classroom observations revealed students periodically having individual problems with their computers that Kim needed to address before the students could complete the task. Kim would try to troubleshoot the problem, but if it took too much of her time, she had the student check out an extra laptop from the library to use during class. Kim always instructed students to email or contact tech support to get their problems rectified as soon as possible. Kim was observed calling tech support from her classroom to explain the problem a student was having on his/her computer. The tech support advised the student to bring his/her computer to the high school the next day so they could fix the problem. Besides the glitches and lack of technical support, students also had difficulties adjusting to a new system of organization.

**Student Disorganization: Messy Lockers to Messy Hard Drives**

The new delivery style and means of handing in assignments caused Kim and her students problems during the one-to-one implementation transition. Kim stated:

It ranges from silly little things like they don’t pay attention when they are saving a file and don’t know how to find it back because they don’t know where they
saved it. We’ve gone from messy lockers to messy hard drives. Those are the kinds of things that we can solve (TI, October 22, 2012).

Some students were observed just clicking “save,” and when Kim wanted them to retrieve the saved document, the students didn't know where it was.

Kim was observed guiding students through the process of making a folder labeled "Language Arts" on their desktop or in their documents. She suggested to the students they create a folder for each of their subject areas so they could save their work in that folder. Kim reminded students to "make conscience decisions as to where you are saving things" (TCA, October 2, 2012; OFN). Kim described some students' disorganization:

There are still a couple of kids who just can't remember where we save things or they don't rename a file so they have quite a stack of untitled documents in their Google drive. And they know how to do it, they just don't think to do it, they just push the button (TI, November 21, 2012).

Last year, students wouldn't know where their assignments were or threw them away when they cleaned out their lockers. With one-to-one laptops this year, Kim said:

The things they are doing online or saving on their computers, they're going to have with them because it's very rare that they don't have their computer with them. I'd say for the majority of the students the organization is built in for them when they have the computers so we are seeing better organization in that regard. I would say that overall, the organization is better for the things they are doing with their computers (TI, November 21, 2012).

Students need better methods of organization to keep track of their assignments in terms of storing them in computer files.

Establishing a new system to organize assignments was not the only adjustment Kim and her students had to make this year. Students needed to learn proper online etiquette and what digital literacy meant.
Digital Illiteracy

The implementation of one-to-one laptops required students learn new skills and information specific to digital literacy. Kim taught a digital literacy exploratory course to all eighth graders. She explained, "There are actually eight strands of digital literacy so it encompasses things like online bullying and it includes online safety. It's not the technical skills of using the programs; it's more about how you act online" (TI, September 27, 2012). Kim thought this course was essential to be taught at a variety of grades during the first year of one-to-one implementation. Once students have been learning in a one-to-one setting for a while, she didn't think a separate class such as this would be necessary; many of the skills could be reinforced throughout each grade level.

In Kim's second interview, she went into more detail regarding the basic training in safety issues that students must receive if they are going to be given a computer.

Students need to understand that when they post things online, they don't control it anymore. They don't know who has copied and pasted it and shared it with others. Photographs they posted online are potentially there forever, and they don't have control over who sees those things. Students need to understand that there's a person on the other end of the computer and the comments they are making need to be carefully considered so they don't embarrass themselves and aren't saying things that are hurtful to others. Some of the gaming students do have become very much social so that would be something we discuss in a couple of lessons. We talk about not giving out too much personal information that would help people know their age or their location and those types of things (TI, October 22, 2012).

The disadvantage of this course was that some students didn't take it until fourth quarter, so they went three-quarters of the year without being properly instructed on how to act online. Kim illustrated this when she explained how students who were in the course first quarter were well aware of the topics discussed and applied what was learned during
language arts. She commented, "I was very impressed with the kids I had first quarter who took it seriously and really showed surprise at some of the things they learned" (TI, November 21, 2012). As the district expands its implementation of one-to-one laptops, students' knowledge, understanding, and application of online safety issues will become imperative.

Making a transition to anything new takes time. Since this was the first year of implementing one-to-one laptops, Kim and her students encountered some barriers. Kim and her students made some progress in overcoming some of the barriers to one-to-one laptops which included lack of time, glitches and lack of technical support, student disorganization, and digital illiteracy.

The final teacher theme that emerged in response to the second research question was "It Breaks My Heart": The Underutilization of Technology. The teacher data that revealed this particular theme were analyses from interviews with Kim, transcripts from classroom activities, Mitch's interview, and observational field notes.

"It Breaks My Heart": The Underutilization of Technology

The implementation of one-to-one laptops in this district has been utilized differently by each teacher. Kim's perception regarding her constructivist practices and the underutilization of the laptops by her colleagues led to the construction of this theme. Kim's perspective about underutilization was clearly evidenced as she discussed teacher resistance.
Unfamiliarity with Constructivist Practices

Constructivist teachers create student-centered lessons that provide students an opportunity to construct their own knowledge. Questions regarding constructivism were asked of Kim in all three of her interviews. Kim stated she was still working on providing opportunities for students to construct their own knowledge. She said, "I do not think that we as a building or a district are there yet" (TI, September 27, 2012). In order to accomplish this, Kim stated, "We need to rethink our lesson design. I think oftentimes in education, students are given information instead of constructing their own knowledge" (TI, October 22, 2012). Kim provided the necessary resources for students to construct their own knowledge as evidenced in observations. When students were developing clues for their Mystery Skype, Kim provided resources from the library and allowed students to search the Internet for interesting facts about their state, school district, and town. Kim described what she views as the relationship between technology and constructivism in a detailed response:

It's interesting that you bring that up, because I feel like I'm not very good as a constructivist teacher yet and that's a direction where I need more training; it's a direction that my students need me to improve my ability to help them with that. I just had a conversation with the superintendent Monday night about that same topic. The easy answer is when students have the world at their fingertips with a laptop computer, they can explore and follow-up on those ideas and they can go looking and gathering information. The next level is to be able to make connections, to connect with another group of students from another state with Skype. Hopefully, when we get into the I search, students can connect with experts through online means, which will give students opportunities to pursue questions they are creating and areas they are interested in learning about.

Constructivism is a different style of teaching than what most of us who are currently teachers were schooled in ourselves, so that leap to teach through the constructivist method is not something that's easy. I think not for me and not for a lot of teachers. But I agree with the research that says this is what students need.
If we are going to have entrepreneurs, we need to teach them how to question, explore, and follow-through on things (TI, November 21, 2012).

Based on Kim's response, teachers in her district would benefit from more professional development on how to create opportunities for students to construct their own knowledge while utilizing technology. The underutilization of technology could be decreased if more teachers had training in how to teach students to construct their own knowledge.

**Teacher Resistance**

Implementing one-to-one laptops in this district also required teachers to change how they delivered instruction and assessed students. Some teachers, like Kim, were eager to make that change, whereas others were more resistant. Teachers in this district must overcome resistance to change in order to successfully integrate one-to-one technology in their instruction. The first change teachers resisted was the acceptance of an additional responsibility. Kim described this additional responsibility: "It is teaching them [students] how to really make use of these tools they have and help them with their troubleshooting" (TI, September 27, 2012). In order to assist students in troubleshooting their computer problems, teacher must have some basic knowledge of computers. Kim disappointedly stated, "There are a lot of teachers who just don't have the knowledge yet to do all the things they will soon do electronically" (TI, September 27, 2012). Because of this, some teachers chose not to integrate one-to-one technology and continued to teach and deliver content within their comfort zones. Kim explained how many teachers in the district were still copying papers and showing resistance to the integration of technology:
It breaks my heart! I had students last week sixth period, who said "This is the first time I have opened my computer today." And I said, "Does that happen often?" "Yes," was their reply. That breaks my heart. What are we spending all this money for if we are not going to use these tools? (TI, October 22, 2012).

This situation didn't happen every day, but Kim added, "If it's one day, it's too many in my view" (TI, October 22, 2012). Kim was very passionate about integrating technology into her curriculum. During every classroom observation, Kim had students utilizing their laptops at least a portion of the class time.

When Kim was modeling how to attach a document to an email message, she asked the students if they knew how to do it. Their social studies teacher taught them the process; this particular teacher was brought up during two different classroom observations when Kim asked if they had been shown how to do something on their computers. Kim and the social studies teacher were the only teachers referenced by students as teachers who frequently integrated one-to-one technology.

Kim attributed the underutilization to the change process: "I think change is difficult for adults; I think it's time consuming and I think it's frightening for some adults" (TI, October 22, 2012). When implementing any new initiative, additional time and commitment is required to implement it successfully. In this district, professional development focused on aligning the Iowa Core with the curriculum, so Kim had not had an opportunity to discuss the underutilization of technology with her colleagues during professional meetings.

When Kim modeled things on her computer for students, all students could see what she was doing on the projection screen. One observation revealed Kim doing
something on her computer that was new to students; they asked her how she did that.

After explaining it to the students and introducing a new online tool, Kim described how the students could use the online tool in other subjects (TCA, October 29, 2012; OFN). If the students hadn't seen Kim use these tools, they wouldn't have been able to utilize them.

Kim said:

I'm surprised the students aren't saying more about it. I think that although there are a few detractors, most of the students like to be able to learn new things on the computer and utilize technology in class, so it surprises me that students aren't more vocal about underutilization (TI, November 21, 2012).

Kim explained a few elementary teachers were high users of technology. Kim hoped “as students come through the grades and have become accustomed to utilizing technology frequently throughout their school day that they will demand it as they move up to the next grade if it's not already happening” (TI, November 21, 2012). The longer the district has the one-to-one technology in place, the more knowledge teachers may gain to integrate it successfully.

The underutilization of one-to-one technology in Kim's district was negating the purpose for implementing such technology. Possible reasons for the underutilization were the lack of teacher training in constructivist teaching and teacher resistance to change.

Four themes emerged in response to the second research question regarding how teachers perceived the learning benefits and barriers of using one-to-one computing. The themes described how one-to-one computing can be a motivating tool that provides students immediate feedback, the ability to move at their own pace, connectivity to the Internet, increased engagement, and acquisition of 21st century skills. Specifically, one-to-one computing provided access to the general education curriculum and promoted
inclusive placements for students with disabilities resulting in social and academic benefits. The themes also described the barriers to the transition to one-to-one computing. Since the implementation of one-to-one laptops was so new, Kim and her students needed to troubleshoot glitches, make adjustments, and learn digital literacy. Underutilization of technology was seen as another barrier of one-to-one computing.

The third research question attempted to address the perceived learning benefits and barriers of using one-to-one computing for students with disabilities. Four themes emerged based on the analysis of data from student interviews (SI), transcripts of classroom activities (TCA), and observational field notes (OFN). These themes were (1) "It's a Great Way to Learn": Life with 1:1 Computing, (2) "It's like Getting Your Driver's License": Student Perspective on 1:1 Computing, (3) "Stressful": Life before 1:1 Computing, and (4) "Oh Boy": Social and Technical Obstacles to First Year Laptop Integration. Each of these themes illustrated Tom and Mitch's perceived learning benefits and barriers of using one-to-one computing in their inclusive language arts classroom.

"It's a Great Way to Learn": Life with 1:1 Computing

The implementation of one-to-one computing had effects on students' perceived learning benefits and barriers. This theme emerged from data gathered from interviews with Tom and Mitch, transcripts of classroom activities, and observational field notes. Tom and Mitch's perspectives about life with one-to-one computing were clearly evidenced as they discussed learning benefits and barriers. Within this theme, Tom and Mitch described several benefits to the implementation of laptops, which included
accessing information, receiving immediate feedback, utilizing spellcheck, and using their own laptop.

**Accessing Information**

Tom and Mitch both mentioned how one-to-one laptops made school and completing assignments easier for them. Tom explained how he accessed and found information online to help him complete specific assignments. Tom described the resources he used:

I use Google mostly for social studies to look things up; there are specific sites that we were using today called cnx.org or British and American New England colonies. In math we are doing Cognitive Tutor and Kahn academy and then in language we are starting HyperStudio today but we have been using Google docs, Gmail, and Firefox (SI, September 27, 2012).

When his teachers put assignments on the computer, Tom said that it’s easier than flipping through a book and, "You could access information just like you could from the book" (SI, October 26, 2012). Tom made many references to the difficulties of "lugging his books around" (SI, September 27, 2012) when he could look up the same information found in his textbook online. Tom commented that when teachers used technology to teach the content, it made it easier for him to learn the material.

**Receiving Immediate Feedback**

Receiving immediate feedback from Kim was another benefit to life with one-to-one computing. Tom and Mitch shared how they felt when Kim provided immediate feedback. Tom said that it helped his learning in a positive way, making it easier. Mitch also liked it when Kim provided immediate feedback and stated:
She understands what your question is and she'll immediately answer it. It helps us because we don't understand and she'll help us one by one or have us in a group and then she'll put it on the front board and write that down or put it on our computer and save it to our favorites so we don't have to go through this over again (SI, November 28, 2012).

Tom and Mitch saw the benefits of immediate feedback from a student perspective, and Kim recognized how the immediate feedback helped students' learning. Receiving immediate feedback gave Tom and Mitch important information that guided their learning and promoted their inclusive placement.

**Utilizing Spellcheck**

Another benefit of using one-to-one laptops was the ability to spellcheck their work. Tom and Mitch both commented they liked the option to spellcheck their work before handing it in. Tom stated, "I always have to ask my parents how to spell something because either I forgot how to spell it or I probably spelled it wrong" (SI, October 26, 2012). The spellcheck tool allowed Tom to be independent when completing his written work. Mitch said technology helped him when he's writing in language arts, "You don't catch it [misspelled words] on paper, but if you write it on a computer, you can catch it so you get more points" (SI, October 3, 2012). Student interviews and classroom observations revealed that Tom and Mitch put forth their best effort when completing assignments. When they got stuck, both students did not hesitate to ask the paraprofessional, Kim, or a peer for help.

**Using Their Own Laptop**

The ability for students to have their own laptop was another perceived benefit to Tom and Mitch. Both students commented last year they really didn't know how to use or
what to do with the laptops because they had to share the mobile laptop cart. Mitch
described how it was easier this year to use the computers because he had his own laptop
and could try new things when he was not in school. "It's a whole lot easier than sharing,"
stated Mitch (SI, November 28, 2012). Both students said that they were getting better
grades this year because they could use the tools available on their laptops and practice
skills learned in school on their laptops when they got home.

Mitch described other learning benefits of one-to-one laptops: "Learning how to
work with technology and trying to get used to it because you're going to need it for
college and your job" (SI, November 28, 2012). Technology is rapidly changing. Mitch
stated, "It's a new way to learn from eighth graders in the past" (SI, November 28, 2012).
He described how he is always learning new things because technology is constantly
changing.

The perceived benefits of integrating one-to-one laptops included accessing
information, receiving immediate feedback, utilizing spellcheck, and using their own
laptops. These benefits were viewed by Tom and Mitch as a great way to learn.

The second student theme that emerged in response to the third research question
was "It's like Getting Your Driver's License": Student Perspective on 1:1 Computing. The
student data that revealed this particular theme were analyses from interviews with Tom
and Mitch, document analysis, transcripts from classroom activities, and observational
field notes.
"It's like Getting Your Driver's License": Student Perspective on 1:1 Computing

Another benefit was the freedom the one-to-one technology provided Tom and Mitch as students. Both students explained more benefits of one-to-one computing, which included increasing student responsibility, becoming mature and smart, and encouraging the implementation of one-to-one laptops in the future.

Increasing Student Responsibility

Implementing one-to-one laptops required students to have more responsibility than what was previously expected. The school district in this study held a "Roll Out" night, which all parents, students, and teachers grades 7 through 12 needed to attend. During this meeting, administrators explained the responsibilities associated with having laptops and the appropriate uses of laptops. The administrators distributed an Acceptable Use Policy document that outlined the aforementioned expectations. Both students described how they felt more responsible when they received their laptop. Tom compared it to getting his driver's license:

You want to be responsible, you don't want to just throw it somewhere and get it damaged. You want to take care of it like it's your own piece of property; you don't want to get it taken away the first day you get it (SI, October 26, 2012).

If Tom mistreated his laptop or forgot to take it with him, the consequence was he would have to leave it at school for one week. A second violation resulted in losing the right to take home his laptop for one month, and a third violation required a parent meeting and a plan to be implemented (document analysis, Acceptable Use Policy). Tom stated he learned his lesson after forgetting his laptop one time.
In addition to treating their laptops appropriately and remembering to take them to every class, Tom and Mitch also said that it was their responsibility to charge them. Mitch explained how difficult it was to learn when he had to sit in the back of the classroom with his back turned in order to charge his computer during class. Mitch commented:

'It's kind of unfair because you are in the way back and you can't really hear what the teacher is saying when they are in the front. Then you have to turn around and look and then turn back around to type and look again and type and it’s just a scrambled mess and they don’t learn as much (SI, October 24, 2012).

Mitch suggested, "No matter what, you should charge it every night once you get home. Try to put a sticky note that says 'remember to charge'" (SI, October 24, 2012). This was also explicitly stated in the Acceptable Use Policy along with other student responsibilities such as maintaining a working laptop, keeping the laptop away from all liquids, cleaning the laptop, properly shutting down the laptop, and keeping the laptop in a locked compartment (document analysis). Tom and Mitch were both observed adhering to these expectations and being responsible for their laptops.

Mitch also exhibited responsibility by creating folders for his work. Mitch commented he felt like a more responsible student because he knew where he saved his assignments. He said you then didn't have to "look through everything on your flash drive or notebook" (SI, October 3, 2012) or "try to explain what you did to [your assignment] and why it was late" (SI, October 24, 2012). Mitch described how creating folders has helped him as a student: "[I'm] more organized, much more organized" (SI, October 24, 2012). A simple application, creating folders, has provided support for Mitch.
in his inclusive language arts classroom. He learned how to organize his work and easily locate saved assignments.

Tom, on the other hand, viewed the creation of folders as fewer items to carry from class to class. He said, "We don't have to, at times, lug our books around or write it down in a notebook. It's easier just to type out the notes in a Word document or Google document" (SI, September 27, 2012). Tom elaborated, "It's [the laptop] portable and you don't have to worry about getting papers torn like in books" (SI, October 26, 2012). Tom only brought his planner, laptop, and Accelerated Reader (AR) to class. Mitch agreed that saving documents on his computer eliminated assignments and pertinent information from being torn in his locker; however, Mitch still carried four textbooks, his trapperkeeper, laptop, AR book, and planner.

Tom and Mitch were informed of the responsibilities associated with having a laptop through the Acceptable Use Policy. They both stated the importance of taking responsibility to charge their laptops each night so they have a full battery the next day. The implementation of one-to-one laptops contributed to both students' increased responsibility regarding saving their assignments.

**Becoming Mature and Smart**

In addition to feeling more responsible, Tom and Mitch said having their own laptop makes them feel mature and smart. They especially felt this way when they assisted their peers. Tom said, "If I figured out how to do something, then I will tell the teacher and then she will tell the class" (SI, September 27, 2012). Tom provided an example of when this happened. "In my digital literacy class, I think, I found out it would
work easier if you went to this certain page. I can't remember what it was, but it helped it get to it [faster]" (SI, October 26, 2012). When Kim had difficulties getting the sound to work to show a new online resource, Tom noticed the volume was muted on her computer (OFN, October 24, 2012). Tom was observed assisting Kim when she was having other problems with her computer.

Tom and Mitch were also observed assisting peers who were have technological problems. Tom said he felt smart when he could help someone. Both students said it made them happy when they could help others. Tom commented, "Like if someone else is having trouble putting it together or turning a blue tooth link or something like that on the computer. I can sometimes just show them how to do it" (SI, September 27, 2012).

Mitch was observed to be more eager to assist his peers than Tom. Mitch assisted classmates in downloading Google Earth, catching up to directions when Kim introduced a new online resource, and answering questions about setting up an account in flashcardmachine.com (OFN, October 29; November 8 & 15, 2012). These examples of peer interaction promoted inclusive placements for Tom and Mitch and made them feel smart and mature. Because of this, both students felt that the implementation of one-to-one laptops should continue.

Encouraging the Implementation of 1:1 Laptops

Many students were observed getting accustomed to the one-to-one technology. Students chose to complete more assignments electronically and felt comfortable solving their own computer problems. Tom described how he would feel if his laptop was taken away tomorrow:
I don't know what I would do because I probably would be kind of mad if I don't have my laptop because I need it for school. I just can't follow if I don't have it. If they are on something that I need to be on, I'm kind of sorry, out of luck (SI, October 26, 2012).

Tom shared how he thought other students would respond if the school removed everyone's laptops. He stated, "They would get mad. Some students really like the laptops and don't really like the books. So I don't think it would go very well" (SI, October 24, 2012). Data revealed that both students wanted to continue the implementation of one-to-one laptops. Each student shared how he would convince a teacher next year to continue to use laptops. Tom reported, "We don't have to flip through as many pages to find what we are looking for. So the teacher doesn't have to write it on the board either, the pages, or look it up in their book" (SI, November 26, 2012). Tom's response echoed previous comments regarding accessing information online and not carrying so many items to each class. Mitch stated:

It's a great way to learn and that you just have your class take their time and they can get it done and if they don't get it done, they can go home and use it. It's also a whole lot easier than sharing. One laptop or two different classes that needed laptops, because that's what happened last year and you had to find different computers. It was really hard to find one (SI, November 28, 2012).

Mitch's response depicted the flexibility one-to-one laptops offer students and teachers. Mitch's preference to owning his laptop compared to sharing laptops was also evidenced in his response.

Tom and Mitch's perspectives of integrating one-to-one laptops were compared to getting their driver's license. The implementation of one-to-one laptops made them feel more responsible, mature, and smart. They also agreed the school should continue to implement one-to-one laptops in the future.
The third student theme that emerged in response to the third research question was "Stressful": Life before 1:1 Computing. This theme emerged from interviews with Tom and Mitch, transcripts from classroom activities, and observational field notes. These data revealed that sharing laptops, using paper, and working without a laptop made life before one-to-one laptops stressful.

"Stressful": Life Before 1:1 Computing

Additional benefits of integrating one-to-one computing were evident as Tom and Mitch discussed life before one-to-one. These inconveniences included sharing laptops from a mobile cart, using paper, and writing everything down. Tom also described feeling "useless without it [laptop]" (SI, September 27, 2012). From this data, the theme "Stressful": Life Before 1:1 Computing was created.

Shared Laptops

Prior to the one-to-one laptop initiative, this school district utilized mobile laptop carts to create a one-to-one environment. Tom and Mitch stated that this exposure helped them become familiar with computers so they knew how to perform some functions this year. Last year the mobile laptops were Macintosh, whereas this year they used personal computers (PCs), which was an adjustment for students. The students commented that last year they worried about finding a computer that was charged and where they saved their assignments. Having their own computers this year eliminated those stressors.

Mitch commented more often than Tom about the convenience and ease of having his own laptop this year. He described how stressful it was for him when the middle schoolers had to share laptops last year:
One day the eighth graders last year, when I was in seventh grade, had the computers the same day and the batteries had about one-fourth of the battery life and it made it harder. Then you had to close that computer, let it charge, and find a different computer to work on and since you don’t sign in to each computer, it’s slow to trying to find your stuff to the desktop part of it (SI, October 24, 2012).

Tom echoed Mitch's words:

Last year we had to go to a cart and sometimes if you went to the cart there would be some computers that weren't fully charged and you'd struggle in finding which computer was fully charged to use with your assignment. I think it's just a lot easier when you have your own computer you can take home and charge (SI, September 27, 2012).

Tom and Mitch found it easier to have control over charging their own laptops this year rather than depending on someone else to charge a shared laptop after using it.

Both students also said it was difficult to find saved assignments on the shared laptops. Tom stated it made him nervous:

All your school assignments were saved and then when you're done with the computer you would have to take it back to the cart, hook it in, and another person would take it if it was their turn and take out the computer and log in as them. I wasn't sure if my stuff would be there or not (SI, November 26, 2012).

Mitch commented it took so much time when he saved his work to a flash drive. Signing on to a computer, loading your flash drive, and finding the assignment was time consuming and stressful for Mitch. This year the students created folders on their laptop's hard drive. During one classroom observation, Kim was giving a lecture that required students to type notes. This lesson was a continuation from the previous day, which required students to save their notes. Tom and Mitch knew where they saved their notes and retrieved them within a reasonable amount of time (OFN, November 15, 2012). The stress of finding a computer that was charged and knowing where they saved their
assignments when using shared laptops were reduced since the replacement of one-to-one laptops.

**Use of Paper**

In addition to sharing laptops, life before one-to-one laptops was a "paper mess" (Tom SI, September 27, 2012). Tom and Mitch described how they had missing assignments, torn papers, wrote everything down, and difficulties paying attention. Mitch described what happened last year with the papers he was given:

> Most of the times, I just shove papers in there [his locker or trapper]. If it's a spelling graph or after a spelling test or pretest, she will give us a paper and I will just put it in there instead of putting it in the folder that I have for it. For social studies I do the same thing and then like after a week or two I say oh, this needs cleaned out. I clean it out and I'm like "what do you know, there's that missing assignment. Oh, they're done." Ok, just hand them in (SI, October 24, 2012).

Tom agreed that last year he, too, had assignments that were done, but lost in the paper mess in his locker. He also described how some assignments were not completed, which caused a "frenzic mess trying to do one paper at one time and another at the same time" (SI, November 26, 2012). By using the laptops this year, Tom and Mitch didn't have as many papers. Tom said the reason for this is because "They [teachers, specifically Kim] are putting most of our assignments on the computer" (SI, October 26, 2012). This decreased the stress Tom and Mitch experienced when trying to locate important papers and assignments. This year, the students saved their assignments to their laptops, which assisted them in retrieving assignments.

The constant writing required last year was also stressful for Tom and Mitch. They had to write notes for each class, write each assignment, and take written tests. Mitch's learning disability in writing made all those tasks even more difficult for him to
accomplish. Mitch described how he felt when he made a mistake when he was writing, "That’s not correct, and I’m like, ‘erase, erase, erase,’ and then you’d have to remember it again and I’m like ‘NO,’ and it’s out of my head" (SI, October 24, 2012). When Mitch was able to complete assignments electronically this year, he said all he had to do was "click it [words] and change it and click and drag it over there without remembering it" (SI, October 24, 2012). The laptop was used as a tool to assist Mitch in writing his thoughts and reorganizing them without having to erase. Mitch stated that he wanted technology to be used more in his classes and the appropriate amount of time would be, "At least for half the class or for half of each period or one quarter" (SI, November 28, 2012). By integrating technology more into instruction, some of the stress Mitch felt when writing assignments could be removed.

Tom did not have a writing goal in his IEP, yet he required more time than his nondisabled peers to process his thoughts. Tom stated when he didn't have a laptop or if he would get his laptop taken away, he had to use his textbook to find the information and draw or write the assignment. Tom was observed taking more time than his peers to accomplish tasks on the computer. Tom took even more time when he was observed completing tasks that required him to draw or write. Tom and Mitch favored using their laptops to complete assignments rather than hand writing them.

Tom was also observed having more difficulties paying attention to the instruction when laptops were not used. Tom was clinically diagnosed with Attention Deficit Disorder. Because of this, Kim had Tom sit in the front row to help him focus. He was observed laying his head down on his laptop on several occasions when Kim was
lecturing or explaining a task. One instance, during the completion of DOL, Tom perked his lying head up and said, "I can look up to see if *The Ghost Owl* is a real story" (TCA, November 8, 2012). He wanted to use his laptop. Tom even commented:

I have some classes I really like to use the laptop in because we usually need it and other times when we don't need to use the laptop, instead we have to use the books, I kind of don't like it (SI, October 26, 2012).

Tom was observed being more engaged when he had the opportunity to use his laptop during class. Tom explained that using the laptop made it easier for him to pay attention and follow instructions. Tom became reliant on his computer for that reason. He also stated that he felt "useless" without it.

*Useless Without it*

Tom and Mitch experienced life last year without one-to-one laptops. Even with laptops this year, sometimes, their laptops had problems and needed to stay with tech support until the problem was fixed. On one occasion, Tom forgot his laptop at school and had it taken away for the day. Tom described how he felt when he didn't have his computer:

It makes me feel like I am useless because I can't go on what my teacher and classmates are on because I'm not able to see it unless it's on the projector. If I don't know what they are talking about for the computer and I don't have mine, I'm not quite sure what I'm doing (SI, October 26, 2012).

On one occasion, Mitch's partner did not have her laptop because she left it with tech support (OFN, November 26, 2012). This required Mitch to share his laptop to successfully complete the task with his partner; however, only one person could use the laptop at a time.
Mitch also said that he liked being able to see the website the teacher was
showing on his own laptop. Mitch described not having a laptop:

If you are in the back of the class and you can’t see it [the projection screen] very
well and then you can ask to move and the teacher will say ‘no’ so then you kind of have to squint your eyes and try to lean forward to see what it is (SI, October 3, 2012).

Mitch liked to navigate through websites on his own rather than watching the teacher do it on a projection screen. This helped Mitch know how to use the website and information to complete the task. Having their laptops available made Tom and Mitch feel they could complete their work better and follow along with the teacher.

Life before one-to-one laptops was stressful for Tom and Mitch. They didn't like sharing laptops from a mobile cart, using paper, and writing everything down. Once Tom and Mitch were exposed to one-to-one laptops, they felt useless when they didn't have them. Life with one-to-one laptops has made their lives at school a little easier.

The final student theme that emerged in response to the third research question was "Oh Boy": Social and Technical Obstacles to First Year Laptop Integration. This theme emerged from interviews with Tom and Mitch, transcripts from classroom activities, and observational field notes. These data revealed students' perceived barriers to the implementation of one-to-one computing.

"Oh Boy": Social and Technical Obstacles to First Year Laptop Integration

Data were collected during the school’s first semester, and many barriers were evident in the transition to one-to-one laptops. In addition to the themes associated with benefits of technology integration, several barriers to that integration were observed or
reported by Tom and Mitch. These barriers included peer distractions, blocked websites, difficulties with WiFi connections, and inability to sync files.

Peer Distractions

Some of Tom and Mitch's frustrations stemmed from peers getting off-task, which was a distraction to Tom and Mitch. Tom stated that some kids, "look up images for their background" (SI, September 27, 2012) and Mitch said, "Some of them play games that they are not supposed to" (SI, October 3, 2012). Tom and Mitch shared that their peers have not been caught by Kim. Classroom observations revealed a handful of students looking up pictures or going to another website when they were given explicit directions as to what they needed to do.

Blocked Websites

In addition to the distraction of their peers being off-task, Tom and Mitch said that blocked websites was another barrier. Tom said, "It's a good thing they actually blocked Facebook, Skype, Twitter, and stuff like that in the school day because there were lots of kids on. So the school decided to block it" (SI, September 27, 2012). Mitch agreed that it's a good thing that the school blocks those websites. Mitch described his frustration when teachers often told him to go to a website and then it was blocked:

Like one time we were trying to use this new website and the company only got one class done so they could only sign in the first class and the other classes couldn't so Mrs. H. had to talk to the other classes. During another class we tried to type in weather and it would say something and you would click on it and it would say something like this website is being blocked and you're like "oh, boy" (SI, October 24, 2012).
Mitch said this confused him because nothing bad on the website exists. When this did happen in class, Mitch stated that the teacher usually went on to the next part of the lesson skipping the integration of technology.

**Difficulties with WiFi Connections**

Connecting to wireless Internet was also a barrier for Tom and Mitch. They traveled between the middle and high school to take exploratory classes, which meant they had to connect to the high school server and connect back to the middle school server after their exploratory class. Mitch commented they did learn how to change their WiFi to connect to the high school and vice versa. Tom encountered a barrier that was a distraction to him:

> When I click on student for Internet connections, there are different connections for the Internet. There's these mixed up letters that people have made them as their own, which are on my computer when I select student, which I don't know why (SI, November 26, 2012).

Mitch had similar troubles connecting to his home Internet. In his last interview, he said he still could not connect to his home Internet using his laptop. He said this was very confusing to him. Since he lives very close to the middle school, his laptop could pick up the school's Internet signal. Because he accessed Internet this way, he hadn't brought the issue up to tech support.

**Inability to Sync Files**

The last barrier that Tom and Mitch mentioned was the inability to access files at home they saved at school. Tom and Mitch shared the same frustration as Kim regarding this barrier. Mitch described how he has to "save it (his assignment) on a flash drive or some other device" (SI, November 28, 2012) when he is working at home. His computer
still wouldn't sync when he turned it on at school. This barrier was something the school's tech support was aware of and in the process of fixing. According to the teacher and student participants in this study, this inability to access files at school students saved at home was the major barrier in implementing one-to-one laptops.

Social and technical obstacles were apparent in Tom and Mitch's first year of laptop implementation. Peer distractions, blocked websites, difficulties with WiFi connections, and the inability to sync files were barriers to implementing this new technology.

Four themes emerged in response to the third research question regarding the perceived learning benefits and barriers of one-to-one computing for students with disabilities. The benefits included accessing information, receiving immediate feedback, and using their own laptop. Additional advantages were identified by students as increasing student responsibilities, becoming mature and smart, and encouraging the implementation of laptops. Benefits of integrating one-to-one computing were evident as Tom and Mitch discussed life before one-to-one. When given their own laptops, students felt a greater sense of responsibility and maturity than they had in previous years. The implementation of one-to-one laptops decreased the stress students felt and inconveniences they encountered from sharing laptops from a mobile cart, using paper, writing everything down, and finding missing papers. Barriers to the implementation of one-to-one laptops were also described. Such barriers included peer distractions, blocked websites, difficulties with WiFi connections, and inability to sync files. The themes described the students' perception of life with and before one-to-one laptops.
In conclusion, 11 themes emerged in response to the three research questions based on an analysis of data from teacher interviews, student interviews, transcripts of classroom activities, observational field notes, and document analysis. Three themes emerged in response to the first research question regarding how teachers integrate one-to-one computing. The first theme, based on an analysis of teacher data, was described as "The World Is at Their Fingertips": Uses of Technology. The next two themes, based on an analysis of student data, were "How to Work with Technology": Student Use of Technology and Teacher as a Leader: "She Is a Good Role Model on How to Use Your Laptop. Four themes emerged in attempt to answer the second research question regarding the teacher's perceived learning benefits and barriers of using one-to-one computing. Based on the analysis of teacher data, these themes were developed (1) Motivation: "The Power of Choice", (2) "Leveling the Playing Field": Students with Disabilities, (3) "This Is Still Very New": A Teacher's Perspective on Technology Integration, and (4) "It Breaks My Heart": The Underutilization of Technology. Finally, the third research question attempted to address the perceived learning benefits and barriers of using one-to-one computing for students with disabilities. Four themes emerged based on the analysis of student data (1) "It's a Great Way to Learn": Life with 1:1 Computing, (2) "It's like Getting Your Driver's License": Student Perspective on 1:1 Computing, (3) "Stressful": Life Before 1:1 Computing, and (4) "Oh Boy": Social and Technical Obstacles to First Year Laptop Integration.
CHAPTER 5

CONCLUSIONS

Both NCLB and IDEA require that technology be integrated into the curriculum. This integration is mandated to decrease the achievement gap between students with disabilities and their nondisabled peers and increase inclusive placements. Technology integration can support students’ acquisition of 21st century competencies (Lowther et al., 2003), improve the quantity and quality of students' writing (Lowther et al., 2003; Russell et al., 2004), and increase academic performance in language arts and science as measured by standardized tests (Dunleavy & Heinecke, 2008; Gulek & Demirtas, 2005). These benefits may be especially important for students with disabilities whose achievement gap is more pronounced. One specific benefit for students with disabilities may be the increased accessibility to the general education curriculum by leveling the playing field through technology integration. Such integration may facilitate greater academic achievement for students with disabilities and reduce the achievement gap.

Yet, even with these known benefits, the integration of technology into the core curriculum for students with disabilities may be insufficient and inadequate. Teachers may not adequately explore possible instructional technology applications for students with and without disabilities. Traditional methodologies of lecturing, PowerPoint presentations, instructional videos, and individual seatwork may not be engaging to all students today. Teachers may be underutilizing a variety of instructional technology capable of increasing students' achievement and engagement in learning. Reasons for this underutilization include limited resources (Hew & Brush, 2007), institutional constraints
(Johnston & Cooley, 2001), subject and school culture (Firestone, 2009), teachers' attitudes and beliefs (Ertmer, 1999), teachers' lack of knowledge and skills (Hew & Brush, 2007), and teachers' unfamiliarity with the digital culture (Considine et al., 2009).

Traditional methodologies may not include structure, readiness for learning, intuitive and analytic thinking, and motives for learning (Bruner, 1960) on which the constructivist approach is based. Modern pedagogy has an increased emphasis on the learner becoming aware of his/her own thought process and actively and personally constructing meaning from knowledge (Schacter & Fagnano, 1999). The integration of technology could provide teachers with more resources to design constructivist lessons that allow students to make meaning of the world around them and construct their own learning. Brooks and Brooks (1993) compiled a list of characteristics a constructivist teacher should display. Teachers should encourage and accept student autonomy and initiative. Data and primary sources, along with manipulative, interactive, and physical materials should be used by a constructivist teacher. When framing tasks, constructivist teachers use cognitive terminology such as “classify,” “analyze,” “predict,” and “create.” Lessons are student-centered and are driven by student responses that shift instructional strategies and alter content. Teachers check students' understandings of concepts by seeking elaboration of students' initial responses before sharing their own understandings of those concepts. This could include encouraging dialogue with both the teacher and other students. Constructivist teachers also engage student inquiry through experiences that might contradict their initial hypotheses, which causes students to ask thoughtful, open-ended questions of each other. A constructivist teacher allows wait time after
posing questions and provides time for students to construct relationships and create metaphors. Finally, constructivist teachers nurture students’ natural curiosity through frequent use of the learning cycle model (Brooks & Brooks, 1993). Learners taught by constructivist teachers use and process communication differently. These characteristics reflect the importance of social learning and students' abilities to problem solve in order to make meaning. With the integration of technology, students can have access to a plethora of information to explore, follow-up, make connections to their inquiries and demonstrate competency of 21st century skills.

Students may not be experiencing the benefits technology can afford in enhancing their content knowledge and 21st century skills. In an inclusive classroom, student engagement is believed to be critical in the learning process. Students who are not engaged may fall further and further behind academically. Students’ lack of understanding of important concepts and skills may cause them to be unprepared for life after high school. Employers are likely to seek individuals who are self-motivated, work as a team, stay on task, and ask clarifying questions. The current behavior demonstrated by students with special needs in an inclusive classroom may limit their opportunities to find appropriate jobs. Many students go home and play video games that are full of action and require the student to think critically and problem solve. Unfortunately, opportunities to use technology in school may be limited. Despite the legal mandate to improve the effectiveness of education for students with disabilities through the integration of technology, access to instructional technology may be limited for these students.
One-to-one computing may be viewed as an alternative, instructional methodology to teach students with special needs in inclusive environments and to reduce the achievement gap. One-to-one computing provides students access to a mobile computing device 24 hours a day, seven days a week. This means students can type their papers, access information, and collaborate with other students wherever they are. Because of the intrinsic motivation some students may have to use electronics, particularly males who are overrepresented in special education programs (Whiting, 2009), the opportunity for one-to-one computer access may provide learning possibilities that can help address the achievement gap for students with disabilities while being educated in the least restrictive environment.

Motivation is influenced by attribution and self-efficacy. Weiner's (1979) theory of achievement, motivation, and emotion explains the expectancy for success when an individual is attempting to accomplish a goal and is concerned with causal inferences that an event has occurred (Weiner, 1979; Weiner, 1985). Students with disabilities may attribute their successes or failures to such causes as ability, effort, mood, luck, or task difficulty. Integrating technology may contribute to more successes for students with disabilities in inclusive settings and increase their self-efficacy. Technology may be an interest for some students, particularly students with disabilities. By integrating technology, students with disabilities may increase the belief they have in themselves to perform a task and reach their goals (Alkin, 1992). Lebow (1993) suggested two ways teachers can design instruction so student achievement and motivation may be improved: (1) instruction must relate to the interests, experiences, and personal goals of the learner
to increase motivation and (2) learning and motivation should be seen as one because they are interdependent processes. Integrating technology could further assist teachers in designing lessons to increase student achievement and motivation.

Many quantitative studies (Dunleavy & Heinecke, 2008; Hembrooke & Gay, 2003; Keengwe et al., 2012; Shapley et al., 2010) and mixed-methods studies (Bebell & Kay, 2010; Corn et al., 2010; Mouza, 2008; Russell et al., 2004; Warschauer, 2008) have examined one-to-one computing applications. However, these studies fail to provide an in-depth examination of teacher and student perceptions regarding the integration. Few qualitative studies exist that have explored teacher and student perceptions measured by participant observation, teacher interview, and student interview. This study carefully and fully examined how one-to-one computing was integrated into an inclusive language arts classroom.

Students with disabilities were the focus of this research. A plethora of research exists that identifies the achievement gap between students with and without disabilities (Kober, 2001; Maleyko & Gawlik, 2011; Wagner, 2008; Williams, 2003). Specifically, the achievement gap is most pronounced during the middle school years. This research examined the perception of teachers and students with disabilities regarding the integration of one-to-one computing in an inclusive language arts class at the middle school level.

The purpose of this study was to examine the integration of technology with students with disabilities, particularly the use of one-to-one computing when used in inclusive classrooms. Much of the research conducted on one-to-one computing has been
reported using quantitative measures; this study took a qualitative approach exploring how one teacher integrated one-to-one computing into the curriculum and how students with disabilities perceived that integration. The data analysis resulted in several themes in response to the research questions:

1. How do teachers integrate one-to-one computing in an inclusive language arts classroom?

2. What do teachers perceive as the learning benefits and barriers of using one-to-one computing in inclusive classrooms?

3. What do students with disabilities perceive as learning benefits and barriers to one-to-one computing?

Eleven themes emerged in response to the three research questions based on an analysis of data from teacher interviews, student interviews, transcripts of classroom activities, observational field notes, and document analysis.

This chapter discusses the conclusions of this study in relation to previous research described in Chapter 2 and the theoretical framework that guided this research. The next section discusses implications and recommendations based on the researcher's findings. The last section of this chapter provides suggestions for practice and further research in the realm of one-to-one computing for students with disabilities.

Conclusions

One conclusion of this study was this teacher was technologically advanced in how she integrated technology compared to her colleagues. Congruently, this teacher's passion, positive attitude, and initiative to seek out opportunities to integrate technology
affected how she integrated technology into her lessons. The findings revealed this teacher used a variety of resources while integrating one-to-one laptops to engage her students. She used online resources, *Moodle*, and software and online assessments. Students similarly reported the integration of a variety of classroom supports and their teacher's efforts to model one-to-one integration. The students specifically described Kim as a role model on how to use new technological applications for academic purposes.

These findings are very distinct from what the literature suggests: most teachers don't adequately integrate technology due to first and second-order barriers (Ertmer, 1999). First-order barriers such as lack of resources cause more frustrations to teachers than second-order barriers because teachers have little control in obtaining resources. Second-order barriers are more personal to the teacher such as the lack of understanding how to integrate technology into lesson plans. Woodrow (1992) states, "Teachers' attitudes toward computers will undeniably play a crucial role in the implementation of any computer skills teachers acquire" (p. 212). If a teacher has a positive attitude towards the integration of technology, then new skills will be learned to design lessons utilizing technology. This is consistent with the research that states negative attitudes could deter computer use in the learning environment (Teo, 2006). A teacher who has learned to integrate technology into his/her lesson designs may also teach differently than a teacher who has limited or no training (Christensen, 2002). The various levels of technology integration were described by the Florida Center for Instructional Technology (2006) in a matrix (see Table 4) aligning the characteristics of meaningful learning environments with the five levels of technology integration. According to this matrix, the teacher in this
study would be at the adaptation level (the teacher encourages adaptation of tool-based software by allowing students to select a tool and modify its use to accomplish the task at hand) or infusion level (the teacher creates a learning environment that infuses the power of technology tools throughout the day across subject areas). When the teacher in this study integrated technology, she was a role model for her students. She delivered relevant, up-to-date information, which made her teaching stronger (Jukes et al., 2010-2011; Okojie, 2011). During this delivery, she modeled how to access information from online resources (Dunleavy et al., 2007) and utilized those resources to complete assignments. This teacher’s inner drive and personal belief in the importance of integrating one-to-one computing was most influential. In their study, Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) concluded teachers’ attitudes and beliefs were not a barrier; rather a facilitator in “providing the passion and drive needed to devote extra time and effort to enact their strong beliefs about good teaching and learning” (p. 433).

The integration of technology differs among teachers. The teacher in this study had a passion for integrating technology, which showed in her utilization of a variety of online resources, Moodle, and assessments. Her positive attitude towards the laptop implementation was evidenced by the students in this study reporting her use of classroom supports and efforts to model one-to-one integration.

The second conclusion of this study was this teacher realized the benefits of integrating one-to-one computing outweighed the barriers. In addition, the teacher in this study was able to use technology to differentiate her instruction for students with
disabilities. The findings revealed many potential learning benefits. The teacher described
the utilization of one-to-one technology as motivating to the students. The teacher also
identified several benefits to the implementation of laptops, which included providing
immediate feedback, pacing students, connecting to the Internet, and increasing student
engagement. An additional benefit was how technology assisted in integrating 21st
century skills in the curriculum. The findings also suggested that this integration of one-
to-one laptops leveled the playing field for students with disabilities by increasing access,
promoting social benefits, and practicing the content at their level.

The literature clearly suggests technology and use of computers can impact
students' motivation and attitudes toward learning (Beck-Hill & Rosen, 2012; Keengwe et
al., 2011; Mouza, 2008; Valdez et al., 1999), particularly males (Whiting, 2009). The
students in this study did not use the term motivation to describe the effect one-to-one
laptops had on their learning. Rather, they stated their preference in utilizing the
technology to complete their work compared to using paper and pencil, which was also
the findings of Russell et al.'s (2004) study. The integration of technology allowed Kim
to provide more choices for her students to complete tasks, which she considered
motivating for students with disabilities (Hasselbring & Glaser, 2000) and also built their
confidence (Bialo & Sivin-Kachala, 1996; Lowther et al., 2003). Kim defined and talked
about metacognition with her students, which has been correlated with increased
motivation for learning with technology (Billig et al., 2001). In their study, Billig et al.
(2001) "emphasized the use of metacognitive skills, application of skills, and inquiry
learning as they infuse technology into their respective academic content areas" (p. 43).
Kim incorporated metacognitive skills into her lessons, which may have also affected students' motivation to learn the content.

The benefits of implementing one-to-one laptops were organized according to the 21st century skills. These skills include critical thinking and problem solving, collaboration, adaptability, entrepreneurialism, oral and written communication, accessing and analyzing information, and curiosity and imagination. They emphasize "what students can do with knowledge, rather than what units of knowledge they have" (Silva, 2009, p. 630). The literature suggests that one-to-one laptops increased students' acquisition of 21st century skills (Barrios et al., 2004). Kim described the ease of designing lessons according to the 21st century skills using one-to-one laptops. The findings of this study showed how Kim created opportunities for students to demonstrate all these skills except adaptability and entrepreneurialism.

Critical thinking is the process by which students conceptualize, apply, analyze, synthesize, and/or evaluate specific content for learning (Mandemach, 2006). The findings of this study showed Kim provided opportunities for students to process the language arts content in such a way. Other studies indicate critical thinking, problem-solving, and higher-order thinking skills were also enhanced in technology-enriched environments (Hopson et al., 2001 - 2002; Kim & Hannafin, 2011; Zydney & Grincewicz, 2011). Reading primary resources online, troubleshooting their computer problems, and analyzing online information were opportunities for students in this study to demonstrate these skills.
This study revealed collaboration skills were encouraged. Students collaborated with another school through Skype, used Google documents and presentations to work collaboratively with peers, and used email. Students were taught how to appropriately collaborate with others online, which is a skill employers are seeking in employees (Jukes et al., 2010 - 2011). Kim described how “the world opened up” to her students now that they have one-to-one laptops (personal communication, September 27, 2012). Students are able to collaborate globally and locally with their peers; this was not a reality for Kim and her students prior to one-to-one laptops. By integrating technological applications that encourage collaboration, Kim is teaching her students the skills necessary to perform successfully in society. These skills have promoted inclusive placements for students with disabilities in Kim's language arts class.

Oral and written communication skills were also encouraged. The findings showed many opportunities were given to students to orally present their work. Kim incorporated online discussion groups. Knowing their peers would read their posts required students to selectively choose their words. The spellcheck option assisted students with disabilities to feel more confident in the work they submit. Warschauer and Liaw (2011) found that online collaborative writing tools have promoted writing fluency and increased students' confidence in writing. Students like Mitch, who have an IEP writing goal, require these writing supports to access the general education curriculum.

Students in this study also accessed and analyzed information found online. Kim provided opportunities for students to access and analyze information online that was relevant to the content they were learning. The findings of this study revealed students
with disabilities preferred this method rather than looking in their textbooks. Tom especially preferred this method. A reason for this could be that he doesn't have Internet access at home like the majority of his peers, which aligns with Christensen and Horn's research (2008) on technology accessibility in school. Technology also fosters students' creative instincts (Okojie, 2011) by providing access to information interesting to the student.

Curiosity and imagination were 21st century skills also demonstrated by students in this study. When Kim differentiated her instruction, she allowed students to create projects and complete tasks creatively. Students' technological skills varied, which permitted some students to demonstrate their creativity more than others. One-to-one laptops increased the opportunities for students with disabilities to learn in different ways, which may have helped reduce the achievement gap and increase their proficiency. Provided as a supplemental aid for students with disabilities, one-to-one laptops promoted students' creativity in inclusive setting.

Twenty-first century skills such as critical thinking and problem solving, collaboration, oral and written communication, accessing and analyzing information, and curiosity and imagination were considered benefits of integrating one-to-one laptops in this study. The teacher was better able to create differentiated lessons that required students to demonstrate these skills using their laptops. By doing this, Kim promoted inclusive placements for students with disabilities.

Using one-to-one laptops also leveled the playing field for students with disabilities. Legislation requires students with disabilities have increased access to the
general education curriculum. This increased access can be more effective "by supporting the development and use of technology, including AT (assistive technology) devices and AT services to maximum accessibility for children with disabilities" [20 U.S.C. §1414(c)(5)(H)]. Accordingly, IEP teams determine appropriate accommodations for students to participate in the general education classroom to the maximum extent appropriate. In 2009 Congress passed the American Recovery and Reinvestment Act of 2009 that "includes a plan for evaluating the State's progress including achievement gaps" [H.R. 1-168, §14005(c)(5) and redistributing "highly qualified teachers between high- and low-poverty schools, and to ensure that low-income and minority children are not taught at higher rates than other children by inexperienced, unqualified, or out-of-field teachers" [H.R. 1-168, §14005(d)(2)]. To meet this provision, some schools have opted for the general and special education teachers to co-teach so extra teacher assistance is provided (Vaughn & Bos, 2009). Even with two adults in the classroom, teachers still have to provide appropriate accommodations and modifications for students who require them. In this study, one-to-one laptops were used to make appropriate accommodations for the successful inclusion of Tom and Mitch in Kim's general education language arts class. "Technology provides access to wider and more flexible learning facilitators, including teachers, parents, and mentors outside the classroom" (Beck-Hill & Rosen, 2012, p. 227). Tom and Mitch not only had access to online information and technological applications, but could also email Kim or chat with their classmates if they had a question regarding their assignments. The findings of the study showed Kim created a community of learners through the use of online discussions. All
students, regardless of disability, participated and contributed to online discussions. This finding also mirrored the findings of West, Jones, and Semon (2012) on promoting community for online learners in special education: "communication, safe environment, supportive instructor, and networking" (p. 112) are factors that contribute to establishing a sense of community. Kim incorporated these factors into her inclusive language arts classroom. Kim used Moodle to differentiate her instruction to meet Tom and Mitch's individual needs. Because the lessons were designed to be completed online, all students were completing the task at their instructional levels; stigmas were not apparent. The data analyzed from Kim's interviews revealed findings similar to those of Mouza et al. (2008). Availability of laptops for students strengthened teachers' attitudes toward the importance of using technology to "differentiate instruction and accommodate different learning styles and interests" (p. 435). Tom and Mitch were permitted to use spellcheck, which accommodated for their writing deficits. Mouza et al.'s (2008) study also found students' writing improved when they used laptops because they could use spellcheck to experiment with new vocabulary words. This may be another reason why Tom and Mitch preferred to complete their assignments using their laptops rather than writing. The implementation of one-to-one laptops also provided a social benefit for students with disabilities in an inclusive environment. Tom and Mitch liked to help their peers who had computer problems. This peer assistance made Tom and Mitch feel mature and smart, which increased their self-confidence. They knew how to solve technological problems that some of their nondisabled peers did not. In return, peers assisted Tom and Mitch with academic problems.
These conclusions are consistent with the literature on motivation, self-attribution, and self-efficacy. Students were persistent in completing tasks using their laptops. This persistent led to increased student engagement. The globalization dimension of the attribution theory was evidenced in the integration of 21st century skills. The self-efficacy of students with disabilities was also affected by Kim’s integration of one-to-one laptops. When Kim provided immediate feedback, individualized instruction, and access to the Internet, the students’ confidence and capability of completing a task successfully increased.

The teacher in this study identified many learning benefits to the integration of one-to-one computing that may be motivating for students. Even though benefits were noted, barriers to the implementation of one-to-one laptops were evident.

Despite numerous benefits, barriers existed in the first-year implementation of one-to-one laptops. A third conclusion of this research was that barriers exist due to the infancy of one-to-one laptop implementation in this school district. The findings suggest several impediments limited first year integration of one-to-one computing. These barriers included lack of time, glitches and lack of technical support, student disorganization, and digital illiteracy. Specific barriers such as resources, institutional leadership, subject and school culture, and teachers' lack of technological knowledge and skills were most prevalent throughout this study.

Technology support was referenced as a resource barrier in this study. Throughout this school district, two people support the technology for the 382 students in grades 7 through 12 who use one-to-one laptops, as well as the prekindergarten through high
school teachers. These tech support personnel have offices in the high school, which is in a different town than the one in which the middle school is located. Kim and her students typically needed to get their laptops to the high school to receive tech support. Receiving a quick response to a computer problem was unlikely, leaving students without a computer for a period of time. Another resource barrier was time, the biggest barrier for Kim. Just like the teachers in Hew and Brush's (2007) study, Kim wanted to experiment with new technological applications so she could teach students how to effectively use them, but time often prohibited her from attaining her goal. Kim tried to find an appropriate balance between working outside of school hours and leaving work at school to avoid burn out, which was also an issue for teachers in Hew and Brush's (2007) study. Not only was time a barrier for Kim outside of school hours, but she also wanted more time in the classroom to do everything with technology that she planned. In a survey of more than 4,000 teachers in over 1,100 schools in the United States, Becker (2000) found most secondary students have less than one hour to do work in any class. Even though Kim had two 40-minute class sessions back-to-back, she still felt the time constraints when designing lessons that integrated technology. This institutional barrier could be rectified by establishing longer class sessions to encourage more integration of one-to-one technology.

A corresponding conclusion is that one-to-one computing was underutilized due to teacher resistance and teachers' unfamiliarity with constructivist practices. Teacher resistance could have been the result of the lack of leadership evident in Kim's building. Teachers who are familiar with constructivist practices integrate technology to engage
students and encourage them to make deeper connections with the information to generate meaning (Overbay, Patterson, Vasu, & Grable, 2010).

A principal does not occupy an office in the building in which Kim works; a Dean of Students, who is also the science teacher, fulfills the building administrator role. This posed problems in regard to a consistent building-wide approach in integrating one-to-one laptops. In Fox and Henri’s (2005) study, teachers called themselves "small potatoes" (p. 164) and looked to the principal to "define the school’s vision and mission and to then inform us of what direction he wants us to go" (p. 164). Hu, Clark, and Ma’s (2003) study also concluded teachers’ acceptance of technology was influenced by its perceived usefulness in meeting their school’s goals and their personal teaching goals. Because of teachers’ resistance to integrating technology, one school district’s technology team in Nebraska decided to collaboratively teach with classroom teachers to model technology integration (Getting buy-in from phobic faculty, 2009). This collaborative teaching and modeling increased the classroom teachers’ utilization of technology. In Kim’s building, a lack of principal leadership to encourage the integration of one-to-one laptops existed. Kim’s building’s subject and school culture regarding the implementation of one-to-one laptops was not clear. Etmer and Ottenbreit-Leftwich (2010) described a "culture pressure" that appears in the "form of norms, values, and shared beliefs among individuals in work and social contexts" (p. 265). Based on Kim’s description of the underutilization of one-to-one laptops in her building, a lack of shared beliefs in integrating one-to-one laptops was present in her building’s culture. According to Selwyn (1999), subject cultures are ultimately influenced by the individual who teaches the
subject area. Kim attributes this inconsistent subject culture to teachers' lack of technological knowledge and skills. The implementation of one-to-one laptops required teachers not only learn technology, but also change how they teach so their classrooms become more student-centered rather than teacher-centered (Ertmer & Ottenbreit-Leftwich, 2010; Fabry & Higgs, 1997). Kim was self-motivated to take technology courses and researched different technological application on her own. Not all teachers in her building have taken that initiative. Kim's school district had specific professional development content established based on other initiatives. This forced teachers to explore other avenues to become knowledgeable about integrating one-to-one laptops in their subject areas. Kim's integration of one-to-one laptops promoted differentiated teaching and learning in her language arts classroom. She implemented a constructivist technology-enriched model (Beck-Hill & Rosen, 2012) that embedded student-centered collaborative activities (Lowther et al., 2003) between students with disabilities and their nondisabled peers as well as between Kim and her students. Using the constructivist model, Kim individualized learning experiences according to students' interests and prior knowledge. Kim stated that technology made it easier for her to do this. A study conducted by Overbay et al. (2010) concluded teachers' constructivist beliefs and practices were positively related to the frequency of technology use. Based on the findings of this research, the teacher perceived the learning benefits outweighed the barriers associated with the infancy of implementing one-to-one laptops.

Students with disabilities shared their perceived benefits and barriers of one-to-one computing. The fourth conclusion of this study was that students' roles changed with
the implementation of one-to-one computing. The findings illustrate the students in this study who had learning disabilities were eager to use their own laptops during class. Students preferred to access information, receive immediate feedback, and utilize spellcheck on their laptops. The findings also suggest laptops provided students additional freedoms such as increasing responsibility, becoming mature and smart, and encouraging the implementation of one-to-one laptops.

The students in this study preferred to access the most current information online rather than use their textbooks. One-to-one computing allowed "just in time" learning (Warschauer, 2008) for students to instantly access information anytime and anywhere (Karsenti & Collin, 2011) rather than waiting until they had access to the Internet or a computer. The increased access to the Internet helped level the playing field for students who do not have Internet access at home (Muir et al., 2005). Receiving immediate feedback and utilizing spellcheck are also noticeable benefits supported by the literature. Warschauer et al. (2010) suggested one-to-one computing had the greatest impact on students' writing. Tom and Mitch received immediate feedback from online assessments such as MyAccess that Kim integrated into instruction, as well as modules created within Moodle. Spellcheck was seen as a benefit to the students when they wrote and revised their work. This tool provided students more independence and encouraged them to write more. Students took more ownership of their learning by changing their roles to that of self-learners, team members, and knowledge managers (McGhee & Kozma, 2003). The students in this study described freedoms associated with one-to-one laptops such as increasing their responsibility, becoming mature and smart, and encouraging the
implementation of one-to-one laptops. The literature agrees students who use one-to-one laptops have higher self-esteem and better attitudes toward learning (Bialo & Sivin-Kachala, 1996). Students in this study, like the student in Lowther et al.'s (2003) study, indicated laptops made completing tasks easier for them, which made the students feel smart. Laptops assisted students in organizing their electronic homework documents. Students in this study felt like more responsible students when they could easily retrieve their homework from their laptops.

A final conclusion of this research was that even though barriers were evident in the first year of one-to-one implementation, students would choose to learn with one-to-one computing rather than return to traditional methods of receiving instruction that were stressful to them. The findings suggest the students in this study exhibited high amounts of stress prior to one-to-one computing. The inconveniences that caused these stressors included sharing laptops from a mobile cart, using paper, and writing everything down. Since the implementation of one-to-one computing, social and technical obstacles were identified by students. These obstacles were peer distractions, blocked websites, difficulties with WiFi connections, and inability to sync files.

Students had access to shared laptops prior to the one-to-one laptop implementation. However, the stress of finding a charged laptop and worrying about locating documents was not ideal for the students in this study. Their preference was to have their own laptop so they were responsible for charging it, saving files, and troubleshooting any problems. The literature suggests students who have their own laptop used it more often than students who had to share laptops (Russell et al., 2004). Rather
than using paper and writing everything down as in a traditional classroom, one-to-one laptops were used by students in this study to take notes, organize their files, and complete and submit assignments. The literature concurs that one-to-one laptops assisted students in organization (Dunleavy et al., 2007) and completing and submitting assignments (Muir et al., 2005). One-to-one laptops alleviated some of the stressors the students with learning disabilities experienced in a traditional classroom. The students in this study also described social and technical obstacles that were the result of the infancy of the laptop implementation. The literature clearly described how one-to-one laptops require teachers to manage their classrooms differently to avoid peer distractions (Dunleavy et al., 2007). Keeping students from going to a different website, looking at pictures, and chatting online are social obstacles for which the teacher must monitor to eliminate possible distractions. Blocked websites, difficulties with WiFi connections, and inability to sync files were seen as first year technical obstacles in this study. These obstacles were evidenced due to the lack of technical support available in this district. The literature agrees technical support personnel get inundated with requests and do not respond as quickly as teachers and students need to get tasks completed (El Semary, 2011; Hew & Brush, 2007; Johnston & Cooley, 2001). These obstacles may become less prominent as the district continues to implement one-to-one laptops.

In the first year of one-to-one laptop implementation, students in this study saw the benefits of their changing roles as students. Even though the students in this study described some barriers to one-to-one implementation, their preference would be to
continue to learn with one-to-one laptops rather than go back to traditional methods of receiving instruction that were stressful to them.

Based on the findings of this study, five conclusions were presented. The first conclusion reflected the teacher’s technological skills and passion for integrating technology. The second conclusion confirmed the learning benefits outweighed the barriers of one-to-one computing. The third conclusion identified barriers of the one-to-one implementation to include the infancy of the initiative, teacher resistance, and teacher unfamiliarity with constructivist practices. The fourth conclusion suggested one-to-one computing changed students’ roles. The final conclusion indicated students’ preferences to learn with one-to-one computing rather than traditional methods.

The conclusions of this study generated implications and recommendations for integrating one-to-one computing. New ideas, practical applications, and possible solutions for integrating one-to-one computing were proposed for teachers and school administrators.

**Implications and Recommendations**

One implication of this study is that in order to successfully integrate one-to-one computing into class instruction, teachers must become more familiar with online and technical resources. One recommendation would be to provide school initiated professional development. This recommendation is consistent with the literature on how to overcome the barriers of technology integration, which states technology training could address both pedagogical and technological needs of teachers, which could influence attitudes and beliefs as well as their knowledge and skill set (Ertmer, 1999;
Hew & Brush, 2007). The Maine Learning Technology Initiative (MLTI) provided professional development at the introductory level and provided teacher supports (Muir et al., 2005). The MLTI knew in order for students to have success with laptops, teachers must be educated on how to use laptops as instructional tools.

Another recommendation is that teachers have time for peer collaboration. Teachers could observe other teachers who are considered to be high-users of one-to-one computing. This observation and collaboration could serve as a model on how to integrate one-to-one computing to the less experienced user, which is consistent with the literature on how to overcome barriers associated with technology integration (Ertmer, 1999; Hew & Brush, 2007). The increased amount of time could be spent researching new technological resources as well as researching how to integrate more technology into the lesson design. Franklin et al.’s (2001) study investigated one-to-one mentoring for in-service teachers. Mentors assisted teachers by providing technical support and troubleshooting problems. Teachers were excited about the skills and computer knowledge they learned to help integrate technology into their instruction.

A second implication of the research is that teachers must know how to integrate one-to-one computing to differentiate their instruction for students with disabilities. The ability to differentiate would promote inclusive placements and increase access to the general education curriculum for students with disabilities. One recommendation would be for general education teachers to become more familiar with students’ IEPs so teachers know students' strengths and weaknesses. This increased familiarity with students’ IEPs would permit teachers to make more meaningful accommodations and differentiate their
instruction according students' interests, abilities, or readiness. For example, teachers in Karsenti and Collin’s (2011) study identified that one-to-one laptops assisted teachers in creating individualized, differentiated learning opportunities for a variety of learners. Dunleavy et al. (2007) also found one-to-one laptops provided self-paced instruction, which would serve as an accommodation for some students with disabilities. Another recommendation is all teachers in a district implementing one-to-one computing receive professional development on how to effectively differentiate their instruction using the available technology. This training could focus on appropriate strategies to implement at various students' instructional levels. For example, teachers could learn how to create choices for students within content, activities, assessment, products, and learning styles to increase student motivation while differentiating according to Bloom’s taxonomy (Roberts & Inman, 2009).

A third implication of this research is that teachers should be familiar with constructivist practices to design technological lessons that allow students to construct their own meaning. One recommendation is to provide professional development for teachers who are unfamiliar with the constructivist approach. This training could explain the roles of a constructivist teacher and how teachers can adapt their current practices to align with those roles. For example, teachers who are familiar with constructivist practices could model student-centered activities that encourage students to construct their own knowledge while utilizing one-to-one computing.

A fourth implication is that schools need to have a shared vision as to how technology will be used in the school district. Teachers want to know how the adaption
and utilization of one-to-one computing will increase learning outcomes (Ertmer & Ottenbreit-Leftwich, 2010), be a valuable teaching tool (Overbay et al., 2010), and meet their school's goals and their personal goals for the classroom (Hu et al., 2003). One recommendation is that before implementation of one-to-one computing, district goals be shared with teachers in regard to how technology should be integrated. Such goals could focus on completing and submitting work electronically, assessing student work, and teachers' changing roles in delivering content. During the implementation, these goals should constantly be monitored, revised, and reflected upon by teachers and administrators to ensure the technology is being integrated in accordance with the district's vision and goals. This recommendation is consistent with the literature on how to overcome the barriers of integrating technology (Hew & Brush, 2007).

A fifth implication is that in order to enhance the benefits associated with one-to-one computing, students must use their laptops in each class every day. Stager (1998) identified several positive outcomes when students used one-to-one laptops such as increased pride in their work, increased connections made between subject areas, increased collaboration and less competition among peers, and learned alongside teachers. One recommendation is that all teachers in a one-to-one school find ways to incorporate the use of technology into their lessons every day. This collaborative effort would model the importance of technology integration for students, fulfill their desire to use their one-to-one devices, and increase their learning outcomes. This is consistent with the literature from Ertmer (1999) and Hew and Brush (2007) on overcoming the barriers of technology integration.
A sixth implication is for technology to be used collaboratively to promote inclusive placements for students with disabilities. Students with and without disabilities are growing up in a digital age and have expertise with technology. Creating a collaborative learning environment would provide opportunities for all students to learn from and collaborate with one another. One recommendation is for teachers to purposefully pair students with and without disabilities so their strengths can be shared. Students who have more technological skills but have difficulties comprehending the content can be partnered with someone who's not as technologically advanced but understands the content. These purposeful placements could promote more inclusive learning environments.

A final implication is that to overcome the barriers and obstacles of one-to-one computing, teachers need more time to experiment with online resources, redesign lessons, and rethink their classroom management styles. This additional time may decrease teacher resistance and increase teachers' technological knowledge and skills. One recommendation is to reduce teachers' class load so they have more time to familiarize themselves with technology and experiment with online resources. This is consistent with the literature on how to overcome the barriers of technology integration (Johnston & Cooley, 2001). Teachers have ideas to integrate technology but the lack of time to find the appropriate tool to assist that integration interferes. Another recommendation is to supply teachers with technology-integrated lesson plans to serve as a model for redesigning their lesson plans. Teachers can follow or adapt these lessons plans so they become more familiar in designing their own technology-integrated lessons.
Suggestions for Future Research

Future research should explore the longitudinal effects of one-to-one computing. Researchers could observe the same teacher in years one and three of one-to-one implementation to compare how the teacher integrated technology after having it for three years. The significance of such a study may reveal time is needed when implementing new technologies. The study may also reveal different learning benefits and barriers associated with one-to-one laptop after three years of integration. The researchers could use the Concerns-Based Adoption Model (C-BAM) created by Hall and Hord (2001) to ascertain how the teacher responded to the change of implementing one-to-one computing. The Levels of Technology Implementation (LoTi) framework (Moersch, 1995) could also be utilized to assess the teacher’s level of technology use before and after the implementation of one-to-one computing.

Another suggestion for future research is to interview students with disabilities in this study in the third year of implementation when they are sophomores, to determine how the integration of one-to-one laptops has impacted their learning. Such a study may reveal they still prefer to use their laptops to complete their work or the preference was temporary due to the novelty of the one-to-one laptop integration in its infancy stage. This study could also compare the academic growth, social confidence, and individual self-efficacy of the students with learning disabilities from the first to third year of utilizing the laptop. Perhaps the researcher could take a quantitative approach and use achievement tests, social rating scales, or self-efficacy scales to determine if growth occurred.
Further research could determine the difference between how relatively novice and more experienced teachers integrate one-to-one computing. The significance of this study may reveal factors associated with teachers' technology integration. People often assume novice teachers would integrate technology more than experienced teachers, but this study could divulge conflicting evidence. Researchers could use the Technology Acceptance Model (TAM) as a theoretical framework (Hu et al., 2003). This framework would allow researchers to determine novice and experienced teachers' perceived usefulness of one-to-one computing and intentions of integrating one-to-one computing.

Another future study could compare inclusive classrooms that integrate one-to-one computing to inclusive classrooms that do not. Such study may illustrate how much effect one-to-one computing has on the learning of students with disabilities. The results may also reveal alternative factors to consider when integrating one-to-one computing in inclusive classrooms. This study may also determine how achievement levels compare between students with and without disabilities when one-to-one computing is and is not utilized.

Another suggestion for future research is to determine the learning benefits and barriers of one-to-one integration for students with more significant disabilities. The significance of this study may reveal alternative benefits and barriers. The study may also reveal if students with significant disabilities could be educated in an inclusive general education classroom with the integration of technology.

A final suggestion for future research would be to explore the effects of educational video games on learning, motivation, and teacher-student relationships of
students with mild disabilities. Such research might show increased peer acceptance and may provide useful suggestions for decreasing the achievement gap.

**Summary**

In summary, this study resulted in five conclusions after examining the integration of one-to-one computing with students with disabilities in an inclusive language arts classroom. Several implications and recommendations regarding the integration of one-to-one computing were proposed for teachers and school administrators. Suggestions for future research concerning one-to-one computing and students with disabilities were offered. These conclusions, implications, and recommendations may provide significant advancements for children with disabilities.
PERSONAL SUMMARY

This study has made me reexamine how I teach courses to pre-service educators who are obtaining their special education endorsements. The findings of this study revealed the benefits of integrating one-to-one computing for students with disabilities. I must model to pre-service educators how they can differentiate instruction according to students' interests, abilities, and readiness levels while integrating technology in inclusive classrooms. I must inform pre-service educators about constructivist practices and the benefits afforded to students when they can construct their own knowledge. This research has made me realize, more than ever, technology is only advancing. My job is to integrate technology and model its use in my daily lessons so pre-service educators have the knowledge and skills to integrate technology when they obtain a teaching job.
REFERENCES


O'Hanlon, C. (2007). A measure of success: the first rounds of data are in, and districts are evaluating the impact of their 1-to-1 programs. With the results showing a revolution in teaching and learning, the task now is to find ways to keep the funding alive. *Technological Horizons in Education, 34*(2), 26 - 31.


Public Law 107 - 110 (Jan. 8, 2002). No Child Left Behind


APPENDIX A

TEACHER INTERVIEW QUESTIONS
1. Demographic questions:
   a. Where did you receive your teaching degree?
   b. How many years have you been teaching?
   c. Where were you teaching before coming to this school district?
   d. Can you provide a chronology of your integration with technology and its integration?

2. How do you provide opportunities for your students with disabilities to construct their own knowledge when using one-to-one technology? What is a specific example of this?

3. How do you design instruction with one-to-one computing so that students acquire 21st century skills?

4. What are your perceived teaching roles in a one-to-one classroom? How do these differ from your roles prior to one-to-one implementation?

5. How have your teaching, learning, and assessment changed by integrating one-to-one technology?

6. What do you consider to be the learning benefits for students with disabilities when one-to-one technology is integrated?

7. What are some barriers to one-to-one technology integration?

8. How do you infuse problem-based exploration and inquiry-based projects utilizing technology into your instruction so that students with disabilities learn essential concepts and skills?

9. How does one-to-one computing assist you in helping students understand how all the parts fit into the whole system? What is a specific example?
10. How do you create a learning environment that intertwines social learning and instructional technology?

11. How do you differentiate your instruction by using one-to-one computing to meet the individual needs of students with disabilities?

12. What do you consider to be the social and personal benefits for students with disabilities when one-to-one computing is integrated into the instructional setting?
APPENDIX B

STUDENT INTERVIEW QUESTIONS
1. Demographic questions:
   a. What sort of technology do you have at home?
   b. How do you use these sorts of technology?
   c. Do you have Internet at home?

2. How does one-to-one computing affect your interaction with your peers?

3. How does using technology make you feel?

4. Do you think one-to-one computing helps you do better in language arts class?

5. What do you learn by watching other students use one-to-one computing?

6. What are the good things about using one-to-one technology in language arts?

7. What do you think are the problems of using one-to-one technology in language arts?

8. Do you think your attention and confidence in language arts have improved with one-to-one computing? How so, can you provide me with a specific example?

9. Do you think your grades and tests scores have improved by using one-to-one computing? If so, can you explain how?

10. Do you think one-to-one technology has affected the way you solve problems and work independently? If so, can you give me an example?

11. How has one-to-one technology helped or hurt you as a student?

12. Has one-to-one technology affected your participation in your language arts class? If so, can you describe how it has changed?

13. What do you like most about learning with one-to-one computing compared to learning without it?

14. How does your teacher use one-to-one computing to help you learn?
15. Can you give me examples of assignments or projects where you have used one-to-one technology?
APPENDIX C

EXAMPLE OF OPEN CODING
Kim

2\textsuperscript{nd} Round Interview

Monday, October 22, 2012

8:00 a.m. – 8:50 a.m.

B: Last time when I asked you how you provide opportunities for students' with disabilities to construct their own knowledge you said that you are still working on that. You said you didn't think the building or district was there yet. What do you think needs to happen so that you are there?

K: I think that we need to rethink our lesson design. Because I think oftentimes in education, students are given information instead of constructing their own knowledge.

B: When talking about students with disabilities, you said that technology helps them learn, they are shy about speaking in front of group, everyone contributes and responds to online discussion groups, they have the same tool so there's no stigma, they are exposed to same things as peers, they understand a whole different point of view, and they gain skills and confidence. You said that when students with disabilities were integrated into your classroom the world opened up and it wasn't frightening or overwhelming because associates were there to help. You and other students gained understanding and compassion. You said you don't label your students, but have an awareness to keep an eye on students who have disabilities in your classroom. Can you tell me more about how technology has helped you, students with disabilities, and their nondisabled peers promote inclusive settings?

K: Oh, I think one of the things we do with technology is work in pairs or small groups and when we are doing that everyone has an opportunity to participate and contribute and ideas can be thrown off each other so there's a lot of give and take between students and everyone is involved and I don't think that anyone is feeling incapable because they are able to work together with a partner or small group. I think that's one of the things that I have enjoyed seeing.

B: Do you think it's easier to have inclusive classrooms with technology available?

K: I don't know if it's easier or just looks a little bit different. You need to remember that every student having a computer is awfully new to me and we are all still figuring out together how this is all going to work.

B: and maybe the severity of the disability could factor into that as well.
K: I think so. I think that’s a good point. I don’t see at all as an issue in my language arts classroom, but in one of my exploratories I teach reading level of online content has been a concern for me.

B: When I asked you about the learning benefits for students with disabilities when 1:1 technology is integrated, you said that differentiation is key and you don’t think you are there yet. Can you tell me why you feel this way?

K: The reason why I feel that differentiation is key is because you can adjust lessons to suit the needs of individual students in a very I don’t want to use covert, but that’s what comes to mind, in a way that’s not obvious to other students when you’re using technology. That takes a lot of time and effort and that’s why I don’t feel like I’m fully there yet.

B: You described all the things you can do in Moodle to help students with disabilities such as practice things multiple times outside of class, hit on different learning styles, use video clips, do different types of exercises, and have class discussion online. You said that you can set MyAccess to give students feedback based on their vocabulary. You also said that you can go back to the MAPs scores and look at the DesCartes to see which skills certain students need and then tailor your lessons within Moodle. Are there other ways to differentiate within Moodle or other online resources that can help students with disabilities in your classroom?

K: I think I hit on a wide variety of ways last time we talked. I can’t think of anything to add to that right now.

B: The only reason I ask is because sometimes you may have heard of something but have not had time to play around with it. And so, I just wanted to know what else you have been exposed to.

K: Yes

B: You said that the top kids typically revolt when you differentiate because they are sliding along. You said that technology will make it easier to hide how you are differentiating in Moodle because everyone will have an assignment but won’t know what the person next to them is doing. You said there would be no stigma. How will this affect your students and you as the teacher?

K: I think for students it builds confidence if they are receiving instruction and practice at their level and they’re finding success. I saw this last week when my students did a self-evaluation for parent-teacher conferences and they were rating their strengths and almost every student felt they were comfortable learning in Moodle and I think that’s a reflection
of their ability to move at their own pace and to have instruction that’s appropriate at their learning levels.

B: And wouldn’t it be interesting to keep those and compare those to the 4th quarter just to see the comfort level of technology. I have noticed in class that there have still been glitches and so just to see how those iron out and how students respond in the end.

K: Yes, it would.

B: Last time when I asked you how you design instruction with 1:1 technology so that students acquire 21st century skills you said that there’s a lot of teaching going on this year that’s more than just content area teaching because kids need to develop those skills to use the computer before they can get to the content area. You mentioned skills such as identifying the URL, copying and pasting, making folders, collections in Google, and renaming documents. You said you didn’t know what your students’ skills were on the computers. Do you have a better idea now?

K: Yes, they’ve mastered many of the basic how to do things and now we are spending more time troubleshooting. Students are learning when things aren’t working, I try this first, then I try this next. So I have seen progress being made in this area.

B: A follow-up question is Can you think of other computer skills that students were lacking?

K: I can’t reteach this, but I’m disappointed in the number of students lacking basic keyboarding skills.

B: in just using the index fingers to type?

K: Yes, I think keyboarding is a skill we have lost in the change of emphasis. When we had a business teacher who was trained to teach keyboarding, our student skills were stronger than what they are now that we no longer have that in our district.

B: What age or grade level do you think that needs to start?

K: I’m not sure. I think it starts very young now, but I don’t think we have a consistent follow-through in our district.
B: I'm just thinking that if the district goal is 1:1 7 – 12, what age do we need to get students prepared for that turn. Really, 5 – 6 could be going there soon, depending, so just a thought. (Kim agreed with the previous statement).

B: I have noticed that you provide much of your class time for students to complete their work at school when they have access to the Internet and you to help answer questions. You said in your last interview that the majority of their homework is to read independently. You have taught students strategies such as converting back and forth between Word and Google documents. You said you have not taught them how to turn a website into a PDF so if they are using a website for research and don't have Internet at home, they can still access it from home using a PDF. Is that true, you haven't shown them that skill?

K: That's correct.

B: What other strategies have you shown your students or are planning on showing them?
APPENDIX D

EXAMPLE OF AXIAL CODING AND CATEGORIZATION
<table>
<thead>
<tr>
<th>Kim’s 2nd Round Axial Coding and Categorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students with Disabilities</td>
</tr>
<tr>
<td>lesson design</td>
</tr>
<tr>
<td>given information</td>
</tr>
<tr>
<td>takes away the power of tech</td>
</tr>
<tr>
<td>construct own knowledge</td>
</tr>
<tr>
<td>work in pairs</td>
</tr>
<tr>
<td>small groups</td>
</tr>
<tr>
<td>choose different roles</td>
</tr>
<tr>
<td>check in regularly to ask questions</td>
</tr>
<tr>
<td>opportunity</td>
</tr>
<tr>
<td>self-reflection</td>
</tr>
<tr>
<td>contribute</td>
</tr>
<tr>
<td>ideas</td>
</tr>
<tr>
<td>give and take assistance</td>
</tr>
<tr>
<td>involved</td>
</tr>
<tr>
<td>don't feel</td>
</tr>
<tr>
<td>reading level</td>
</tr>
<tr>
<td>online content</td>
</tr>
<tr>
<td>adjust lessons</td>
</tr>
<tr>
<td>needs of students</td>
</tr>
</tbody>
</table>
Transcripts of Classroom Activities

<table>
<thead>
<tr>
<th>Teaching techniques</th>
<th>Tech used</th>
<th>Barriers</th>
<th>Immediate Feedback</th>
<th>Teacher's Perception on Student learning</th>
<th>Students' Tech skills</th>
<th>Teacher Perspective on Tech integration</th>
<th>Digital Literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>uses multiple learning styles</td>
<td>Google presentations</td>
<td>computer is configuring models</td>
<td>Choose font style, size</td>
<td>it's wonderful</td>
<td>doesn't like</td>
<td>away</td>
<td>identity</td>
</tr>
<tr>
<td>new version - Star Reading Program</td>
<td>remembering username &amp; passwords</td>
<td>I'm going to show you</td>
<td>create username &amp; passwords</td>
<td>Skype connection could effect clarity</td>
<td>help organize your cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>target skills for individuals based on diagnostic info</td>
<td>Hyperstudio presentations, online resources</td>
<td>I will answer individual questions</td>
<td>complete practice quiz</td>
<td>speak clearly &amp; distinctly look into camera</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>creates vocabulary cards</td>
<td>Mystery Skype, flashcardmachine, MyAccess</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Field Notes

<table>
<thead>
<tr>
<th>Teaching techniques</th>
<th>Classroom Management</th>
<th>Immediate Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>modeled everything she did</td>
<td>pairs of students were off-task</td>
<td>hurried around the classroom to help each student</td>
</tr>
<tr>
<td>explicit directions</td>
<td>registering at different stages of AR quizzes</td>
<td>made sure students at different stages of practice Skype as well as what to work on</td>
</tr>
<tr>
<td>troubleshoot with student</td>
<td>student was on-task</td>
<td>positive feedback when practiced</td>
</tr>
</tbody>
</table>

*teacher’s perception on student learning:*
- immediately choose font style, size (it’s wonderful)
- immediate feedback: doesn’t like (away)
- digital literacy: doesn’t give away (identity)
APPENDIX E

KIM’S CONSTANT COMPARISON AFTER SECOND ROUND DATA COLLECTION
### Kim's Constant Comparative between 1st & 2nd round data collection

<table>
<thead>
<tr>
<th>Students with disabilities</th>
<th>Barriers of Tech</th>
<th>Technology Used</th>
<th>Benefits of Tech</th>
<th>Teacher Perspective on Tech integration</th>
<th>Digital Literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>construct own knowledge</td>
<td>lots of teachers don't have knowledge</td>
<td>Moodle</td>
<td>match student &amp; learning</td>
<td>troubleshooter</td>
<td>online bullying</td>
</tr>
<tr>
<td>everyone contributes</td>
<td>lack of consistent</td>
<td></td>
<td>wide variety of ways to teach</td>
<td>frustrating</td>
<td></td>
</tr>
<tr>
<td>to online discussion</td>
<td>follow-through in</td>
<td>online resources</td>
<td>different differentiate</td>
<td>online safety</td>
<td></td>
</tr>
<tr>
<td>ideas</td>
<td>district</td>
<td>MyAccess</td>
<td>immediate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>don't feel incapable</td>
<td>glitches</td>
<td></td>
<td>still need human</td>
<td></td>
<td></td>
</tr>
<tr>
<td>say things online</td>
<td>restrictions on computers</td>
<td>Star Reading Program</td>
<td>feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>they wouldn't say out loud</td>
<td>don't have time to</td>
<td>Google Docs/presentation</td>
<td>individualize instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>needs of individual students</td>
<td>create individual lessons for all my ideas</td>
<td></td>
<td>having the knowledge of technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>builds confidence</td>
<td>computers</td>
<td></td>
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<tr>
<td>student engagement rises</td>
<td>Star Reading Program</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>students are more</td>
<td>Google</td>
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<tr>
<td>motivated</td>
<td>Docs/presentation</td>
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<tr>
<td>practice at their level</td>
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<tr>
<td>appropriate instruction</td>
<td></td>
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<tr>
<td>find success associates</td>
<td></td>
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<tr>
<td>own pace</td>
<td></td>
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<tr>
<td>thoughtful &amp; honest</td>
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</tr>
</tbody>
</table>

### Transcripts of Classroom Activities

- Google docs
  - uses multiple learning styles
  - organization
  - do things differently
  - differentiates student choice in partners
  - target skills for individuals based on diagnostic info.
  - models step by step process

### Field Notes

- modelled
  - everything
  - she did
  - positive feedback when practiced
  - Skype as well as
  - what to work on

- hurried around the classroom to help each student
- off-task

- pairs of students were
  - off-task

- students at different stages of registering
  - pairs of students were
    - off-task
APPENDIX F

THIRD ROUND INTERVIEW QUESTIONS ALIGNED WITH:

TARGETS FROM SECOND ROUND

LITERATURE REVIEW

THEORETICAL FRAMEWORK

RESEARCH QUESTIONS
Kim’s 3rd Round Interview

Date: November 21, 2012

Time: 2:37 p.m. – 4:00 p.m.

Targeted areas established after 1st round data collection: individualized supports, peer interaction, classroom management, teacher facilitation of the technology, and student's interaction with the technology

1. Last time when I asked you if you have a better idea of what your students’ computer skills were you said that many of them have mastered the basic how to do things and now are spending more time troubleshooting. You have seen progress in kids troubleshooting because they know to try one thing first and then another before asking for help. You said you are most disappointed in students’ lack of basic keyboarding skills. You said you used to have a business teacher who taught this, which made students’ skills stronger. Because of your district technology goals, do you think more emphasis will be placed on keyboarding skills in earlier grades?

2. You said it depends on the nature of the assignment whether students work individually or independently. You said that I have seen much individual work in language where students were learning about capitalization and punctuation. You said literature has more opportunities for students to work in pairs or small groups. You said that you will be doing a couple units with literature circles. How do students respond to this variety? Does it appear they prefer one method over the other?

3. When I asked how you thought your students like this change of delivery you said you didn’t know if it was the change of delivery as much as the ability to work at their own pace. And students like that when they are on the computer, the way I have set up the lessons and quizzes is that they know right after they have answered a question what the right answer is and they like that confirmation of knowing they were right or they like to if they missed a problem, they like to know what the right answer is right away. That immediate feedback is something students have really liked. Is this correct?

4. When asked about off-task behavior, you said that they are 8th graders and they will find a way to be off-task in any type of learning environment. You said you use proximity and sometimes remind students of the acceptable use policy they signed. Is this correct?

5. When I asked if 1:1 laptops had impacted your classroom management or changed your rules and expectations, you said that you moved your desk so that
you could see students' computer screens. You said you have always roamed around the room, but do it more so that students will ask questions rather than just push a button if they are not sure. You didn't think a whole lot else has changed for classroom management. Have you done or plan on changing any of your classroom management techniques because of the integration of 1:1?

Review of Lit:

- **Barriers:** resources (cost, access, time), institutional leadership, subject culture, teachers' attitudes & beliefs, lack of technological knowledge and skills, increased emphasis on standards tests, digital divide

1. When I asked you about the kinds of computer problems students typically have you said silly things like not remembering where they saved a file. You said students have gone from messy lockers to messy hard drives. You said those aren’t the frustrating issues; the frustrating issues are problems with accessing the Internet and accessing files at home. Has this gotten better? Do students seem to be more organized or getting there with 1:1?

2. When I asked you what other strategies you have shown your students or are planning on showing them you said you are not showing them any new things right now until you and tech people can figure out why students can’t access files that are saved at school at home, access internet at home, or have their files automatically sync and save to the server when they restart their computers at school. You said you are facing much frustration when nearly half your students have this issue. You said that it’s taking away the power of placing this technology in students’ hands. Has this issue been resolved? How was it handled? What have you been doing to accommodate the students who had this problem?

3. Last time you explained more about the digital literacy exploratory class you teach. You said that you thought it is essential to teach digital literacy the first year of 1:1 implementation and once students have been in that environment for a while, you don’t think it would be necessary. You said that you think it’s important that students get basic training in safety issues such as: understanding that when they post things online, they don’t control it anymore, they don’t know who has copied and pasted it and shared it with others, photographs they posted online are potentially there forever and they don’t have control over who sees those things, there’s a person on the other end of the computer and that the comments they are making need to be carefully considered so that they don’t embarrass themselves and so that they aren’t saying things that are hurtful to others, and not to give out too much personal information that would help people know their age or location. I also asked if social media such as Facebook and Twitter were addressed in this class and you said that gaming has also become very social. You said you address it in a couple of lessons. Are students who have taken this course applying those skills?
4. I asked you to tell me more about how you were struggling with time. You said that time is still an issue and will always be, but it's making that match between students and learning that's on your mind these days. Would you consider time to be your greatest barrier in integrating everything you want to?

5. I also asked you if you have seen other barriers besides the ones you already mentioned, saving files and being able to transfer that home. You said just the difficulty of some students not having equal access to the Internet when they take their computers home. You said that some students don't know as much about computers as others, but you didn't think that was any different than students who have deficits in certain areas in a traditional classroom. How do you handle this in your classroom? Is this consistent throughout the building?

6. When I asked you how you felt about teachers in the district still copying off papers and not doing things electronically, you said it broke your heart. You said that you try to have students open their computers every day. You asked, "What are we spending all this money for if we are not going to use these tools?" when you heard students had not used their computers until they came to your classroom 6th period. You said that change is difficult for adults, it's time consuming, and it's frightening for some adults. Do you have any other thoughts about the underutilization of this technology?

- **Benefits:** critical thinking & problem solving, collaboration, adaptability, entrepreneurialism, oral & written communication, accessing & analyzing information, curiosity & imagination, motivation

1. When I asked you how else technology has saved you time you said that using technology as a diagnostic tool was most exciting to you. You said there's a time saver when you can create a multiple choice or true/false quiz and the computer can correct that for you. You said those are not always the best ways to gather information on your students and with constructive response, students might prefer to do it on the computer, but it's still as much work to correct their work. As much as some things can be corrected using the computer, you are still spending more time on preparation to deliver lessons and practices on the computer. So you didn't think that it was huge time saver in that regard. When I asked about MyAccess you said that students get immediate feedback but it's the kind of feedback that a machine can give you, students still need a human element. How do provide them with that human element?

2. Students have both made comments about how 1:1 computing has made them more responsible and mature. Tom actually made an analogy that having a laptop was like having a driver's license. What do you think about those comments?

3. Part of my research involves 21st century skills for classroom content. Those include critical thinking & problem solving, collaboration, adaptability, which really means the ability of students to be flexible, innovative, and autonomous, entrepreneurialism, which really means having self-direction to set goals related
to learning, plan for the achievement of those goals, independently manage time and effort, and independently assess the quality of learning and any products that result from the learning experience, oral & written communication, accessing & analyzing information, and curiosity & imagination, which allows students to take a more active role in learning, explore the world and get instantaneous feedback about discoveries. I was interested in whether or not you see any relationship between technology and these 21st century skills? (additional probing based on how she responds).

4. You explained the difference between an “I” search and a traditional research paper. You said you would like to use an “I” search so that students conduct a personal interview, which might be Skype, might be an online discussion, might be as simply as a questionnaires they create in email, but to get a first person source incorporated in their research. You said a big part of an I search versus a traditional paper is the addition of a reflection where students are writing about their process and also writing about their discoveries and the personal impact it has on them. What 21st century skills do you think would be applied during an “I” search?

5. When we were talking about engagement and motivation, you also said students’ online self-reflections are very thoughtful and honest, which is an exciting discovery. You said students are very comfortable typing their thoughts and they say things online that they wouldn’t say out loud. You said you can structure the reflections to be privately read by you or shared with their peers. You said that students choose their words differently if they know their peers are going to read it, but you said it’s good for students to understand the relationship between what they write and the audience they are writing for. Can you tell me more about how their writing skills have been affected by the integration of 1:1?

- promote inclusive placements for students with disabilities and increased access to instructional technology:
  1. When I asked you how technology has helped you, students with disabilities, and their nondisabled peers promote inclusive settings you said that you use technology to work in pairs or small groups. There is much give and take where everyone has an opportunity to participate and contribute ideas. You said you didn’t think anyone felt incapable and you enjoyed seeing that. You said it’s not necessarily easier to have an inclusive classroom with technology available rather it just looks a little bit different. You said having every student with a computer is awfully new to you and you are still figuring things out. How does it look different?
  2. When I asked why you give students a choice whether they want to write or type their answers you said they are new to 1:1 and some are more comfortable than
others. You also said there is a power in choice. You don’t want to penalize students who are not keen on technology if it’s the content you are interested in. What percentage of students do think choose to write versus type? Do students like this choice?

3. Another part of literature suggested that I reviewed the law in terms of the need to promote inclusive placements for students with disabilities and access to the general curriculum. Do you have any comments about the relationship between instructional technology and those requirements?

4. When I asked if Tom’s behavior affects how you use technology, you said that I observed the results of him making a poor choice for his partner. He does require extra time and chooses to be thoughtful and thorough. You said you check in with him regularly to see if adjustments need to be made, but he seems comfortable and seldom needs to have adjustments. If adjustments need to be made, how do go about doing that?

- supporting literacy instruction for students with disabilities

1. You’ve given me many great examples of these individual supports such as differentiating using Moodle. Can you give me other examples of how this technology has supported your literacy instruction?

Theoretical Framework:

- Motivation Theories (student): attribution & self-efficacy

1. When I asked you to tell me more about how students are more motivated and engaged when they can use them with technology, you said that when you watch students sometimes they are totally focused on their computers and what they doing online. You wondered if this was totally good. You said that online threaded discussions are a different type of engagement where students are talking with one another online. You said that kids are so focused on technology that engagement just occurs. Do you have any other comments on the motivational effects of instructional technology?

- Constructivist Theory (teacher)

1. Last time when I asked you what your building and district needs to do so that opportunities are provided for students with disabilities to construct their own knowledge you said you need to rethink your lesson design because students are often given information instead of constructing their own knowledge. In our first interview you gave me an example of how you used interactive Venn Diagrams where students constructed their own ideas for comparing a story you read in class to another version you found online. Is this correct?

2. Some of the research I have been reading on constructivist teachers describes them as using student-centered lessons that are driven by student responses that shift instructional strategies and alter content. Teachers check students’ understandings of concepts by seeking elaboration of students’ initial responses
before sharing their own understandings of those concepts. This could include encouraging dialogue with both the teacher and other students. Constructivist teachers also engage student inquiry through experiences that might contradict their initial hypotheses, which causes students to ask thoughtful, open-ended questions of each other. A constructivist teacher allows wait time after posing questions and provides time for students to construct relationships and create metaphors. Finally, constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model (Brooks & Brooks, 1993). Learners taught by constructivist teachers use and process communication differently. I have seen many of these characteristics throughout my observations and you said you talk to your students about the concept of metacognition. What do you see as the relationship between technology and this sort of delivery of the curriculum or content?

3. When I asked you how you balance the need to provide face-to-face time and online learning, you said it's built into the lesson design and you seek out the best approach for the goals you have. Can you give me an example of a lesson that would be most appropriately delivered face-to-face and online learning?

- **social constructivist**
- **conditions of learning**

1. When we talked about differentiation last time, you said it takes much time and effort and that's why you don't feel like you are there yet. You did provide a wide variety of ways in which you differentiate in Moodle. You said that you think students' confidence builds if they are receiving instruction and practice at their level, can move at their own pace, and they're finding success. This was reflective in a self-evaluation you administered to students. You said it builds students' confidence. Do you think they can independently accomplish task to achieve a goal? Why do you think that?

2. When I asked you if you think students expect this immediate feedback when you and them have laptops and you said that they style of learning is new enough for them that they didn't have that preconceived expectation. You also said that they really like it and if it were taken away, they would demand it back. You explained that if students immediately correct a word right after they have first written it, the wrong answer doesn't have time to imprint on their brain. You said that if they can correct misconceptions immediately, rather than giving their incorrect way a chance to become routine, it's easier to break out of those old habits. You said it may not be as efficient, but it's better for kids. Is this correct?
Research questions:

- **How do teachers integrate one-to-one computing in an inclusive language arts classroom?**
  1. I'm really interested in how you integrate technology. These are all the things I have seen you use or you have told me you use: online stories, Venn diagram, Moodle, create groups, differentiate lessons and assignments, change the types of activities, use video clips, standards-based *I search*, DesCartes for MAPs, STAR Reading program, Gmail account, HyperStudio, Firefox, Internet Explorer, modeled each step, classtools.net, *Naiku*, Keystone website, online quizzes, review PowerPoints, literature circles, Google presentations and Docs, *Skype*, *flashcardmachine.com*, *spellingcity.com*, *MyAccess*, what else do you have to add to this list?
  2. How has the use of *flashcardmachine* affected students’ learning?

- **What do teachers perceive as the learning benefits and barriers of using one-to-one computing in inclusive classrooms?**
  1. So far you have told me all these benefits of 1:1 learning: student engagement rises, students are more motivated, builds confidence, find success, students are comfortable working in groups across the room, students can practice a skill multiple times at their appropriate instructional level, they are active in *Moodle* discussions, students get immediate feedback, it's easier to differentiate to individualize learning, you hit different learning styles, provide opportunities for students to learn independently at their own pace, no stigma. Can you think of any other benefits?
  2. So far you have told me all these barriers of 1:1 learning: some students can't connect to the Internet at home, restrictions on computers, computers are not automatically syncing from home to school like they should be, glitches that need to be troubleshooted, not everything is done online, students still need the human element for feedback. Can you think of any other learning barriers when using 1:1?
  3. I know this is kind of hard for me to keep asking you questions, I just want to make sure I am not missing anything about your perceptions of 1:1. Can you think of any other learning benefits or barriers of using one-to-one in your inclusive language arts class?
APPENDIX G

KIM'S FINAL CONSTANT COMPARATIVE INCLUDING THEMES
<table>
<thead>
<tr>
<th>Motivation: &quot;The power of choice&quot;</th>
<th>&quot;Leveling the Playing Field&quot;: Students with disabilities</th>
<th>&quot;This is still very new&quot;: A Teacher’s Perspective on Tech integration</th>
<th>&quot;It breaks my heart&quot;: The underutilization of technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moodle</td>
<td>diagnostic tool</td>
<td>level the playing field</td>
<td>troubleshooter</td>
</tr>
<tr>
<td>online resources</td>
<td>wide variety of ways to differentiate</td>
<td>still need human</td>
<td>lack of consistent follow-through in district</td>
</tr>
<tr>
<td>MyAccess</td>
<td>immediate feedback</td>
<td>online discussion</td>
<td>glitches</td>
</tr>
<tr>
<td>Star Reading Program</td>
<td>individualize</td>
<td>even tradeoff</td>
<td>restrictions on computers</td>
</tr>
<tr>
<td>Google Docs/presentation</td>
<td>instruction</td>
<td>everyone contributes to online discussion</td>
<td>don’t have time to create individual lessons for all my students</td>
</tr>
<tr>
<td>online tool to randomly pair</td>
<td>hit on different learning styles</td>
<td>say things online they wouldn’t say out loud</td>
<td>lots of teachers don’t have knowledge</td>
</tr>
<tr>
<td>students</td>
<td>different types of exercises</td>
<td>needs of individual students</td>
<td></td>
</tr>
<tr>
<td>learning style quizzes</td>
<td>match student &amp; learner</td>
<td>students are more motivated</td>
<td></td>
</tr>
<tr>
<td>flashcardmachine</td>
<td>student engagement rises</td>
<td>builds confidence</td>
<td></td>
</tr>
<tr>
<td>ebooks</td>
<td>adjust lessons</td>
<td>own pace</td>
<td></td>
</tr>
<tr>
<td>Wiggio</td>
<td></td>
<td>appropriate instruction</td>
<td></td>
</tr>
<tr>
<td>google as a search engine</td>
<td></td>
<td>find success</td>
<td></td>
</tr>
<tr>
<td>readwritethink</td>
<td></td>
<td>associates</td>
<td></td>
</tr>
<tr>
<td>ệt Partials of Classroom Activities</td>
<td></td>
<td>thoughtful &amp; honest</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transcripts of Classroom Activities</th>
<th>Different roles in Skype: back channel, blogger, videographer, mapper, presenter, mystery solver, Google Earth, notetaker double the brain power - work in pairs</th>
<th>doesn’t that look kind of fun?</th>
<th>troubleshoot - hold down power button for 30 sec. &amp; plug in screen is black when hooked into projector I don’t have your username/password there’s something wrong with my computer error message open a new doc if you couldn’t open your other one print in library I’m typing too fast? I’ll move content down so you can see it</th>
</tr>
</thead>
<tbody>
<tr>
<td>form for parents to complete to</td>
<td>target skills for individuals based on diagnostic info, models step-by-step process, student choice</td>
<td>doesn’t that look kind of fun?</td>
<td>troubleshoot - hold down power button for 30 sec. &amp; plug in screen is black when hooked into projector I don’t have your username/password there’s something wrong with my computer error message open a new doc if you couldn’t open your other one print in library I’m typing too fast? I’ll move content down so you can see it</td>
</tr>
<tr>
<td>permission to use Wiggio</td>
<td>in partners, uses multiple learning styles, differentiates can do quick searches when you are making guesses</td>
<td>do things differently practice your cards on flashcardmachine don’t be surprised if they ask you to repeat in Skype organization</td>
<td></td>
</tr>
<tr>
<td>email</td>
<td>immediate feedback</td>
<td>build confidence in your own pace</td>
<td></td>
</tr>
<tr>
<td>literature circles - electronically</td>
<td>search for the link</td>
<td>find success</td>
<td></td>
</tr>
<tr>
<td>create new account flashdrive</td>
<td>give choices</td>
<td>associates</td>
<td></td>
</tr>
<tr>
<td>Today’s Meet search website</td>
<td>search for the link</td>
<td>thoughtful &amp; honest</td>
<td></td>
</tr>
<tr>
<td>Venn Diagram - classroots.net</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venn Diagram - readwritethink</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google Docs Wiggio Skype</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Field Notes

pairs of students were off-task
modeled everything she did positive feedback when practiced
students downloaded Skype as well as videos & pix to flashdrive
provided links in email guided notes
used a clicker to display information on screen
cassette tape
flashcard machine
story map on readwritethink
venn diagram on readwritethink
paulreverehouse.org/ride
Google Images

had students collaborate to complete story map
 talked individually to a pair of students who were not working together to complete task
 analyzed poem & online information
 associated assisted encouraging more collaboration between pairs

hurried around the classroom to help each student
constantly monitoring
students at different stages of registering
quickly created PPT to display info that came up in pairs of students were previous class off-task
analyzed poem & online information
associated assisted
encouraging more collaboration between pairs

pairs of students were off-task
APPENDIX H

STUDENTS' FINAL CONSTANT COMPARATIVE INCLUDING THEMES
## Final Constant Comparative between Tom and Mitch using Interviews, Transcripts from Classroom activities and Observational Fieldnote Data

<table>
<thead>
<tr>
<th>&quot;It's a great way to learn&quot;: Life with 1:1</th>
<th>&quot;It's like getting your driver's license&quot;: student perspective with 1:1</th>
<th>&quot;Stressful&quot;: Life without 1:1</th>
<th>&quot;How to work with technology&quot;: Student use of Technology</th>
<th>Teacher Responsibility: &quot;Being a good role model on how to use your laptop&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>easier to access information</td>
<td>Computing charge it every night - most days we use laptops</td>
<td>shared computers</td>
<td>need it for college &amp; your job</td>
<td>teacher emails assignments</td>
</tr>
<tr>
<td>don't worry about papers getting torn</td>
<td>more responsible</td>
<td>used trapper, book, &amp; notebook</td>
<td>Moodle</td>
<td>help us learn how to do each step</td>
</tr>
<tr>
<td>quiz myself save it to desktop</td>
<td>makes me happy</td>
<td>hard to pay attention</td>
<td>word/Google doc look up questions</td>
<td>fewer spelling words</td>
</tr>
<tr>
<td>Own pace Own time on quiz messages from teacher portable</td>
<td>ontask mature &amp; smart</td>
<td>know where work is</td>
<td>don't like using textbook</td>
<td>good role model take care of how to use a computer</td>
</tr>
<tr>
<td>pressure to turn in assignments has been taken off work is easier Work with partner on something &amp; don't have to be in the same place prefers to work independently more organized</td>
<td>missing assignments</td>
<td>upload assignments</td>
<td>Change WIFI spellcheck, review, &amp; revise</td>
<td>thinks real quick write it on the whiteboard - URL</td>
</tr>
</tbody>
</table>
APPENDIX I

TEACHER MEMBER CHECK
Kim’s Member Check:

Themes:

1. "The World Is at Their Fingertips:" Uses of Technology (answered Research Question 1)
   a. Online resources
      i. Classtools.net
      ii. Readwritethink.org
      iii. Wiggio
         1. Literature circles
      iv. Gmail
      v. Flashcardmachine.com
      vi. Spellingcity.com
      vii. Ebooks
      viii. Online stories
   ix. Video clips
      x. Standards-based “I” search
     xi. Firefox
    xii. Internet Explorer
    xiii. Keystone website
    xiv. Google presentations and Docs
     xv. Skype
     xvi. Naiku
   b. Moodle - Learning Management Systems
      i. Create groups
      ii. Differentiate lessons and assignments
      iii. Change the types of activities
     iv. Review PowerPoints
     v. Modeled each step
     vi. Online quizzes
   c. Software/Online Assessments
      i. MAPs – DesCartes - online assessment
      ii. STAR Reading Program - online assessment
      iii. HyperStudio - software
     iv. MyAccess - software

Kim, do you agree with these subheadings and the content under each or should some things be moved?

   a. Benefits of technology
      i. Immediate Feedback – Kim: “If students are doing an exercise or a quiz, I can give them immediate feedback that is tailored to their answer.”
      ii. Move at own pace
iii. Connectivity
b. 21st century skills - Kim: “I think it makes it easier for me to design lessons that will appeal to students while targeting some of those particular skills. It will be the hook.”
c. Student engagement rises

Kim, would you agree with these headings?

3. "Leveling the Playing Field:" Students with disabilities (answered Research Question 2)
   a. Access
   b. Even tradeoff
   c. Don’t feel incapable - Kim: “There’s a lot of give and take between students and everyone is involved and I don’t think that anyone is feeling incapable because they are able to work together with a partner or small group.”
      i. Participate
      ii. Contribute to groups
      iii. Have ideas
      iv. Construct own knowledge
      v. Builds confidence
      vi. Becomes teacher helper
   d. Practice at their own level
      i. Individualizes learning

Kim, would you agree with these headings?

4. "This Is Still Very New:" A Teacher’s Perspective on Tech integration (answered Research Question 2)
   a. Barriers to technology
      i. Time
      ii. Glitches
      iii. Hounding tech support – Kim: “I’ve been hounding our tech people.”
   b. Messy lockers to messy hard drives
      i. Organization is built-in
      ii. Need to know where to save
   c. Digital Literacy

Kim, would you agree with these headings?

5. "It Breaks My Heart:" The Underutilization of Technology (answered Research Question 2)
   a. Constructivist teaching – Kim: “Constructivist is a different style of teaching than what most of us who are currently teachers were schooled in ourselves, so that leap to teach through the constructivist method is not something that’s easy.”
   b. Change is difficult for some adults
      i. Time consuming
      ii. Frightening for some
APPENDIX J

STUDENT MEMBER CHECK
Tom and Mitch's Member Checks:

Themes:

1. "How to Work with Technology:" Student Use of Technology (answered Research Question 1)
   a. Online resources
      i. Classtools.net
      ii. Readwritethink.org
      iii. Wiggio
         1. Literature circles
      iv. Gmail
      v. Flashcardmachine.com
         1. Vocabulary words
      vi. Spellingcity.com
      vii. Ebooks
      viii. Online stories
      ix. Video clips
      x. Firefox
      xi. Internet Explorer
      xii. Keystone website
      xiii. Google presentations and Docs
      xiv. Skype
      xv. Cognitive tutor
      xvi. Khan Academy
   b. Moodle
      i. Own pace
      ii. Own time for quizzes
      iii. Quiz myself
   c. Uses of technology
      i. Play games
      ii. Talk to friends
      iii. Download music and programs
      iv. Facebook
      v. Spellcheck, review, & revise

2. Teacher as a Leader: "She Is a Good Role Model on How to Use Your Laptop" (answered Research Question 1)
   a. Mrs. H emails assignments
      i. You have to upload assignments
      ii. Pressure to turn in assignments has been taken off
   b. Helps us learn how to do each step - M: "When she has it on the projector, and she like spells it out for you or writes it on the board, then you can
type that in and then see. And then she goes step by step on what to do on that website."
   i. Shows us where we need to be

3. "It's a Great Way to Learn:" Life with 1:1 (answered Research Question 3)
   a. Benefits
      i. Easier to access information online - Tom: "You could access information just like you could find from the book, but it seems a little easier carrying the laptop than it is the book."
      ii. Folders
          1. Help with organization
          2. Don't have as many worksheets or books to carry
      iii. My own laptop
   b. Barriers
      i. Some websites blocked
      ii. WIFI connection

4. "It's Like Getting Your Driver's License:" student perspective with 1:1 Computing (answered Research Question 3)
   a. More responsible - Tom: "It's just like that because you want to be responsible; you don't want to just throw it somewhere and get it damaged. You want to take care of it like it's your own piece of property."
   b. More mature & smart
   c. Makes me happy and want to help others
   d. On-task

5. "Stressful:" Life Before 1:1 (answered Research Question 3)
   a. Laptops, but weren't ours
      i. Don't have to worry about sharing - M: "It's a whole lot easier than sharing. One class or two different classes that needed laptops, because that's what happened last year and you had to find different computers. It was really hard to find one."
      ii. Low battery
      iii. Had to find one that was charged
   b. Used paper and wrote everything down
      i. Paper mess
      ii. Missing assignments
      iii. Hard to pay attention
      iv. Erase, erase, erase
   c. Useless without it