The Impact of Digital Education on Learning and Teaching

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Abstract

The purpose of this study was to identify how teachers can transform teaching and learning by integrating 21st century digital technology. In this paper, teacher action research was used to investigate the impact of digital education on teaching and learning. The main research question was ‘How can teachers integrate digital technology into their teaching practice in order to transform teaching and learning?’ The study was conducted in a suburban Jewish day school in the Northeast, in the teacher-researcher’s seventh and eighth grade social science classes. In an iterative cycle of research, reflection and revision, the teacher-researcher integrated technology interventions into his teaching while also collecting data. Two surveys and one interview were conducted to triangulate the data collected from examining student work and the teacher’s reflexive journal. The findings from the study suggest: (a) student motivation can lead to deeper student engagement; (b) digital projects can represent a ‘high water mark’ of student learning; (c) the teacher’s technological-pedagogical content knowledge (TPACK) is vitally important and (d) technology has tremendous potential to contribute to constructivist learning environment. Teacher choices determine whether student enthusiasm translates into deeper engagement with course content. Digital assignments that encourage deeper student learning were identified as representing a ‘high water mark’ of student learning, where the finished project captures the depth of the students’ conceptual understanding. This did not always occur and was dependent on alignment between the assignment goals, students and technology. The implications for this research are that teachers must learn to apply their emerging TPACK in order to effectively integrate technology into their teaching. Even when teaching with technology, teaching and teacher still matter.
Keywords: technology integration, teacher action research, technological-pedagogical-content knowledge (TPACK), social science, history, computer programming, teacher leadership, constructivism, Jewish day school, digital education, teaching and learning.
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Chapter One - Introduction

Statement of the Problem

In the past two decades, digital technology has become pervasive, impacting virtually every aspect of our daily lives. New technologies are having an impact on society at an unprecedented rate. Information distribution is now instant, unfiltered and free. Ubiquitous Internet access has radically changed notions of knowledge, expertise and access to information. Ben-David Kolikant (2009) points out that “the school system – unlike other cultural institutions such as banks, hospitals, the entertainment world, and the press – has not re-thought … goals and practices … in the digital age” (p. 132). This is true in Jewish education as well. Woocher (2008) argues that Jewish educators must “take seriously that the world has changed, and that Jewish education has not changed fast enough or far enough to keep pace with these changes” (p. 38). In light of the transformational impact of digital technology over the last two decades (Tapscott (1998); Prensky (2001); November, (2010)), a crucial question for Jewish education is how to best respond to this changing milieu.

According to the National Educational Technology Plan (2010):

The challenge for our education system is to leverage technology to create relevant learning experiences that mirror students’ daily lives and the reality of their futures. … To prepare students to learn throughout their lives and in settings far beyond classrooms, we must change what and how we teach to match what people need to know, how they learn, and where and when they learn. We must bring 21st century technology into learning in meaningful ways to engage, motivate, and inspire learners of all ages to achieve (p. 26).

This aptly describes the challenges facing all schools, and Jewish day schools in
particular. Schools must determine whether they are indeed teaching children for the world in which the children are growing up. Ben-David Kolikant (2009) warns that if schools fail to adapt to the new digital reality, students will devalue the educational value of schools and “[schools will lose legitimacy as a learning-to-learn institution” (p. 142). Heafner & Friedman (2008) suggest that “nearly ubiquitous access to the Internet has been a boon to the K–12 social studies classroom,” as it can provide “access to information [that] can allow teachers and students to engage in constructivist and inquiry learning in which students are active participants in learning processes that focus on their generating and developing products, rather than being passive recipients of knowledge” (p. 289).

**Purpose of the Study**

The purpose of this study is to identify how teachers can transform teaching and learning by integrating 21st century digital technology. The findings of this research advance scholarly knowledge by adding to the academic literature on teaching across the curriculum with technology, as well as the specific literature about social science education, while also contributing to practice by providing guidance to teachers who are actualizing these ideas in the field. Additionally, this study allows practitioners in the particular venue of the Jewish day school to begin to imagine what teaching with technology in their classrooms can look like.

**Significance of Research Problem**

Over a decade ago, the digital world proved it could survive the turning of the calendar and would continue to be the defining force of the age in the new millennium. The dramatic impact of new technologies was just starting to be noticed, but still barely understood. Prensky (2001) proposed the definitive metaphor of the age, suggesting that the impact of digital technology was so profound that it created a generational divide so wide that it was if the
younger generation came from a new country. Prensky (2001) labeled the younger generation ‘digital natives,’ because they were “all ‘native speakers’ of the digital language of computers, video games and the Internet,” in contrast with the older generation known as ‘digital immigrants,’ because they “speak an outdated language (that of the pre-digital age)” (p. 2).

Prensky (2001) claimed that this gap was a tremendous challenge to the existing structures of school, because “students have changed radically. Today’s students are no longer the people our educational system was designed to teach. … They think and process information fundamentally differently from their predecessors” (p. 1). Schools were losing relevancy, as digital immigrant teachers failed to connect with their digital native students. Thus, “teachers have to learn to communicate in the language and style of their students” (p. 4).

In the subsequent decade, use of digital technologies has become even more widespread. While some schools are making efforts to respond to this changing reality, many schools are still struggling to respond to this rapidly changing world. Unfortunately, most Jewish day school students are still learning in schools that were designed to train them to be part of the workforce of the 20th century. Many of the current structures, curricula and teaching methods are no longer effective at reaching children growing up in today's world. The evidence is overwhelming that the environment in which students are growing up today is radically different than that of their teachers. This has significant implications for Jewish education. As Amkraut (2011) explains:

We find ourselves amid the ongoing digital revolution. … These seminal shifts in contemporary culture profoundly influence an increasingly individualized society and indeed may be transforming Jewish life. The impact of these most significant developments will shape the face of Jewish education (p. 597).
Change is necessary across the field of education, not just within the unique context of Jewish day schools. The U.S. Department of Education (2010) argues the content and structure of education must effectively integrate technology in order to adequately prepare students to live and act in the world in which they are growing up. While there is much written in the popular press about the transformative impact of digital learning on society and education, many of these publications are supported more by enthusiasm than evidence. There is a need for rigorous academic research that identifies how digital education can be deliberately and effectively used to positively transform teaching and learning across subject matter areas.

Evidence of the overwhelming failure of history teaching on a nation-wide level was published in “The Nation’s Report Card: U.S. History,” a 2010 national study of American students. Nationally representative samples of more than 30,000 students from 4th, 8th and 12th grade participated in the study, responding to questions “designed to measure their knowledge of American history in the context of democracy, culture, technological and economic changes, and America’s changing world role” (National Center for Education Statistics, 2011, p. 3). According to the report on the results, “less than one-quarter of students perform at or above the Proficient level in 2010” (NCES, 2011, p. 4). Even more distressing, the scores decline as the students get older, with only 20 percent of fourth-graders, 17 percent of eighth-graders and 12 percent of high school seniors demonstrating proficiency on the assessment (NCES, 2011, p. 2). This indicates that there is vast room for improvement in the effectiveness of current history education in America.

**Positionality Statement**

In order to conduct this study while simultaneously maintaining my role as teacher for the classroom in which this study was conducted, I was required to integrate these roles and become
a teacher action researcher. Herr and Anderson (2005) describe a “continuum of positionality in action research” (p. 30). According to this continuum, I was positioned as an ‘insider’ to the research setting because I was a veteran teacher studying teaching and learning in my own classroom. As the researcher and practitioner for this study, I was very aware that there were inherent biases. Despite occasional reservations about new technologies not living up to their promise, my own bias when I began this study leaned toward curious enthusiasm about digital education. I traced this bias from my own experience as an elementary school student struggling with penmanship. I remembered my excitement helping my parents unwrap and plug in our first personal computer, an Apple IIC. When I learned about the cursor and the way that text could be manipulated in a word processing program, my mind was opened to the possibilities of using technology as a tool to enhance and transform learning. I have typed every assignment I have worked on since fourth grade.

As I conducted this research, I continually challenged myself to be aware of my bias, and not be seduced by my students’ enthusiasm for new electronic toys. Many of the students in this study shared my bias and projected the attitude that classroom learning is ‘better’ due to increased use of digital technology. In response, I made sure my assessments of the impact of these technologies probed deeper than simply asking the participants “Did you like that digital learning experience?” I constantly reminded myself that student engagement with a lesson was not the same as student learning. Conversely, I was also aware of the students and parents who had the opposite bias. I tried to maintain a non-judgmental stance with students and parents in this study who were not enthusiastic about digital technology.

Another personal bias of which I was aware was that I had a personal and professional self-interest in the success of anything that occurred in my classroom. I constantly maintained
this awareness and was cognizant of the impact this role had on my understanding of the research data. While as a researcher I was interested in uncovering processes and determining honest assessments of the digital education interventions, as a teacher my professional reputation benefited from their success. I stood to benefit more professionally from positive ‘buzz’ about technology integration in my teaching than a thoughtful reflection on what did not work with an intervention. I was also invested in the success of the school that I was using as my research site.

I must also acknowledge there were aspects of my school, as a Jewish day school, that distinguished it from public schools in the broader field of education. As a teacher, I was granted tremendous autonomy to develop and implement my curriculum. The technology interventions that I used in this study were a result of this autonomy. However, this autonomy was also coupled with great responsibility. As I implemented the technology integration primarily on my own, I was also held accountable for the impact of my teaching methodology on student learning.

Another unique aspect of the research site as a Jewish day school was the relationship of the school, and myself as a teacher to the national Jewish day school field. According to the Avi Chai Foundation, there are about 800 Jewish day schools in the United States, serving just over 200,000 students (Schick, 2009). These schools, and their leadership, interact with each other in a number of formal and informal networks, including print publications, online website and social media, and an annual national conference. Thus, my research has potential to have a national impact.

Research Questions

How can teachers integrate digital technology into their teaching practice in order to transform teaching and learning?
Sub-questions:

- How can digital technology integration affect teachers’ knowledge and skills?
- How can digital technology integration affect content in the classroom?
- How can digital technology integration affect student learning?
- How can digital technology integration affect the relationship between the teacher, the student and the content?

These sub-questions are structured around the triangular ‘Instructional Core’ of learning (City, Elmore, Fiarman, & Teitel, 2009).

**Conceptual Framework**

This research examines teachers’ use of digital technology to transform the classroom learning environment. As a result the theoretical framework has to include the role of the teacher, the student and content. City et al. (2009) suggest the term ‘Instructional Core,’ to describe “the essential interaction between teacher, student, and content that creates the basis of learning” (p. 22). The Instructional Core can be understood as a triangle with teacher, student and content at each of the three corners. (See Figure 1.) Learning occurs based on the nature of the interaction between these three elements. Any change in learning outcomes, City et al. argue, is a result of a change that is evident on the triangle. Thus, “there are only three ways to improve student learning: … You can raise the level of the content that students are taught. You can increase the skill and knowledge that teachers bring to the teaching of that content. And you can increase the level of students’ active learning of the content. That’s it” (City et al., 2009, p. 22).
The Instructional Core: Teacher

The element of ‘teacher’ on the Instructional Core refers to what the teacher does in the classroom, an expression of the choices that the teacher makes in planning and implementing a lesson plan. A teacher’s effectiveness is dependent on his or her skill and knowledge of pedagogy. In order to bring further conceptual depth to this analysis, Shulman’s (1986) conception of teacher knowledge guides this research. Shulman (1986) argues that in order to develop working theories about effective content-specific pedagogy, teachers must integrate two bodies of knowledge: the discipline-specific content knowledge of the field they are teaching and pedagogical knowledge about effective teaching methods. Shulman (1986) terms this ‘pedagogical-content knowledge’ or PCK (1986).
Two decades later, Mishra and Koehler (2006) argues that knowledge of technology is an important and distinct element of overall teacher knowledge. They modify Shulman’s (1986) original concept of PCK, and propose the concept of technological pedagogical content knowledge, TPACK, as a conceptual framework to understand teacher knowledge. Technology is identified as a third element of teacher knowledge (Mishra & Koehler, 2006). Mishra and Koehler (2006) argue that the rapid rate of change of technology over the last two decades has altered the context in which teachers acquire knowledge. “Thus, knowledge of technology becomes an important aspect of overall teacher knowledge” (Mishra & Koehler, 2006, p. 1024). The TPACK “framework … emphasizes the connections, interactions, affordances, and constraints between and among content, pedagogy, and technology” (Mishra & Koehler, 2006, p. 1025). Teachers must be aware not just of the relationship between the pedagogy and content knowledge of their specific discipline and age level, but also the relationship of technology to each of these. Mishra and Koehler (2006) argue that in addition to developing content-
appropriate pedagogy, teachers must understand how to effectively integrate technology in relationship to specific content and pedagogy. A teacher applies his or her TPACK to determine how to integrate technology appropriately in order to support teaching and learning. As is evident in Figure 3, a teacher’s TPACK occurs at the overlap of knowledge of pedagogy, content, and technology. Skiba (2010) demonstrates the application of TPACK by suggesting the question that teachers must be able to answer every time they integrate technology into their teaching: “Am I being digitally wise in my decision to facilitate the student’s learning by using this particular technology” (p. 252).

The theory of TPACK was an important conceptual framework for this research, as it was
the focus for the analysis of the teacher element of the Instructional Core. The development of
the teacher’s TPACK was analyzed in order to understand instructional decisions made by the
teacher that impacted the student-teacher-content triangle.

**The Instructional Core: Content**

In regards to content, City et al. (2009) are interested in how concepts are presented, the
nature of the tasks students are asked to complete, the difficulty of content and the level of
challenge. This research was conducted in a middle school social science classroom. Thus, the
content element of the Instructional Core is history and social science. The focus on content was
effective teaching of history should avoid rote memorization of dates and names, but instead
encourage students to learn to think like historians and engage deeply with primary sources and
historical controversies. Wineburg’s (2007) research uncovers specific skills that must be taught
for students to engage meaningfully in the process of historical inquiry. The ability to read
primary documents critically is identified as an essential literacy skill for historians (Wineburg &
Wilson, 1991). The critical thinking that historians do, which Wineburg (2007) terms ‘reading
like a historian,’ requires the skills of *sourcing*, considering the document’s author and his or her
purpose, *contextualization*, placing the document at particular time and location, and
*corroboration*, comparing multiple accounts against each other (Wineburg & Wilson, 1991).
Reisman (2012) demonstrates the impact that this approach can have on history students,
encouraging real depth in their historical thinking and inquiry.

**The Instructional Core: Student**

The student element in the Instructional Core refers to what students do in the classroom,
with a focus on the level of active student learning. For this research, I am interested in the
opportunity to use digital education to encourage constructivist learning. Thus, Papert’s (1980) theory of constructionism is an appropriate lens to examine student learning. According to this theory, people learn best when provided with opportunities to design, create, and build meaningful projects. Constructionist learning environments provide opportunities for modeling useful real life learning habits by their emphasis on learning by designing, creating, programming, and sharing with the community (Bers, 2008).

While the constructivist approach is valuable for all forms of learning, there are some specific aspects of social studies instruction that make constructivism of particular relevance. Heafner and Friedman (2008) argue that when social studies courses are taught using constructivist pedagogy, students become actively engaged in content matter and the goal of social science education is achieved as the students are better prepared to become active participants in civic society. New digital technologies such as ubiquitous Internet access have made constructivist pedagogy much more obtainable, allowing “teachers and students to engage in constructivist and inquiry learning in which students are active participants in learning processes that focus on their generating and developing products, rather than being passive recipients of knowledge (Doolittle & Hicks, 2003; Hannafin & Hill, 2002)” (Heafner & Friedman, 2008, p. 289). In a social science classroom that encourages constructivist learning, students are actively engaged in generating meaningful understanding of content material. Heafner and Friedman (2008) studied an attempt to shift from a behaviorist to constructivist pedagogy in a social science class, through the use of student-created online wikis. Hernández-Ramos & De La Paz (2009) provide another compelling example of how digital technology could be a vehicle to introduce constructivist pedagogy to a social science class. They describe an early 19th century American history unit where students created online multi-media
documentaries, resulting in a “technology-assisted project based learning” experience (Hernández-Ramos & De La Paz, 2009, p. 151).

**Schematic Diagram Description**

Figure 4 illustrates the relationship between the various theoretical frameworks that were applied while conducting this research. The theory of the Instructional Core is a central concept, so the triangle is situated at the center of the diagram. At each corner of the triangle, more specific theories are applied to each element. Papert’s (1980) constructionism guides analysis of student learning. Mishra and Koehler’s (2006) concept of ‘technological-pedagogical content knowledge’ is the lens that is used to analyze teacher knowledge. Wineburg’s (2001) conception of teaching history through the approach of ‘historical inquiry’ and ‘reading like a historian’ was used to analyze the content element of the Instructional Core triangle. The interaction between the three elements takes place within a larger context. I was seeking to understand the impact of digital education on learning in the Instructional Core. Thus, digital education is the larger context in which the triangle is situated. This is represented on the schematic diagram by the circle labeled ‘digital education’ surrounding the triangle, representing the context.
Figure 4
Chapter 2 - Literature Review

The purpose of this literature review is to identify and learn from current research in the areas of teacher-leadership, technology integration, social science instruction, and in particular the overlap of these areas. The literature review begins with an exploration of material from the broader field of general education, then focuses on the specific area related to the research question, technology in social science education. Bodies of research to explore include technology integration in education, teacher leadership, technology and professional development for teachers, and social science instruction.

Technological Pedagogical Content Knowledge

In recent years, there has been much written about the impact of technology on society, children and education. As this body of knowledge has developed, academic research has emerged, offering conceptual frameworks to analyze and assess some of the broad trends that are transforming the world in which we live. While November (2010) describes the implications of the digital revolution on learning and student empowerment, the TPACK framework proposed by Mishra & Koehler (2006) provides a way to understand the significance and impact of technology on teachers. Mishra and Koehler (2006) adds another layer to Shulman’s concept of pedagogical content knowledge, or PCK (1986), suggesting that the thoughtful integration of technology in education is a result of the interplay between the teacher’s technological, pedagogical and content knowledge, or TPACK, (Mishra & Koehler, 2006). Thus, as a teacher adapts lesson plans by introducing a new technology to the classroom, planning decisions are informed by the teacher’s TPACK. This framework is helpful in understanding how teachers’

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1 In Thompson & Mishra, 2007, the “consonant heavy,” (p. 28) acronym TPCK was renamed TPACK. Subsequent publications reflect this change.
knowledge about digital technology impacts their ability to effectively integrate this technology and lead in classrooms of today and tomorrow. According to Mishra and Koehler (2006), “knowledge of technology becomes an important aspect of overall teacher knowledge” (p. 1024). Significantly, this is situated knowledge that exists in relationship to a teacher’s knowledge of specific pedagogies and content being taught. This results in a teacher’s technological pedagogical content knowledge, which is “an emergent form of knowledge” (Mishra & Koehler, 2006, p. 1029). Knowledge of how to teach effectively emerges from the integration of what the teacher knows about technology, about how to teach students effectively, as well as the course content. According to Mishra & Koehler (2006):

TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones (p. 1029).

Whether or not it is obvious that technology is being employed in a given lesson, Mishra and Koehler (2006) argue, in today’s classrooms “TPCK is a form of knowledge that expert teachers bring to play anytime they teach” (p. 1031). Sometimes the teacher decides not to use digital technology in a particular lesson. This is the ideal decision if it emerged as the result of the teacher’s reflecting on all three elements of his or her TPACK. The significance of Mishra and Koehler’s contribution is the manner in which the concept of TPACK integrates three elements of teacher knowledge – pedagogy, content and technology. While a teacher may be an
expert in one of these three elements, the master teacher is able to integrate these three knowledge bases. To effectively execute this “requires developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific strategies and representations” (Mishra & Koehler, 2006, p. 1029).

Mishra and Koehler’s contribution has been profound. The influence of TPACK is evident from the massive number of citations it has received – almost 1,500 peer-reviewed journal articles in less than a decade. This can be attributed to the variety of applications for the conceptual framework, including as a framework for pedagogy and as an analytical tool for research. Mishra and Koehler (2006) suggest that TPACK can be applied to develop pedagogy for teacher professional development. Following the principles of TPACK, learning-by-design is the most effective way to expand teachers’ abilities to meaningfully integrate technology in their teaching practice. Through hands-on learning experiences, veteran and novice teachers alike can participate in meaningful professional development that has the purpose of improving each teacher’s TPACK. As a descriptive framework, TPACK can be used to describe what is occurring in a particular learning situation, providing researchers both language and theories to “conceptualize and discuss a complex web of relationships in a methodological, grounded manner” (Mishra & Koehler, 2006, p. 1044). Mishra and Koehler indicate that the TPACK framework can be used as a research tool to assess teacher’s developing understanding of how to integrate their pedagogical content knowledge with what they know about technology. TPACK “provides an analytic framework and categorization schemes for the analysis of teacher knowledge and its evolution” (Mishra & Koehler, 2006, p. 1045). In Koehler and Mishra (2005), the authors demonstrate the application of a survey instrument they developed to assess teachers’
TPACK.

**Applying TPACK**

Mishra and Koehler’s (2006) work has earned its claim as a seminal piece of literature when studying technology integration. Thus, TPACK is the primary conceptual lens for the literature review. Allan, Erickson, Brookhouse and Johnson (2010) demonstrated how to apply TPACK in their study of teachers in Maine. They studied the implementation of a one-to-one laptop program using the TPACK framework to analyze teachers in this process, and found a “collaborative approach to technology-focused curriculum development [that] is a model for TPACK professional development” (Allan et al., 2010, p. 36). The introduction of this new technology was accompanied by intensive three-year professional development for teachers, creating a research opportunity to study the teachers’ emerging TPACKs. Using the structure proposed by Mishra and Koehler (2006), Allan et al. (2010) conclude that in addition to the successful implementation of the laptop initiative, “teacher professional development with a strong TPACK focus also occurred” (p. 41).

Kopcha (2010), influenced by Mishra and Koehler (2006), also focused on teacher professional development as the avenue to encourage technology integration in schools. In place of expensive, hired consultants, Kopcha (2010) suggests a systems-based mentoring model of professional development. Using research about effective professional development for teachers, Kopcha proposes a system built on four stages of development, culminating in the creation of a teacher-led community of practice. This concept aligns with the phases that teachers pass through when learning to integrate technology proposed by Mills & Tincher (2003).

The research of Gao et al. (2010) supports technology integration as a vehicle to encourage teacher leadership, documenting the experience of novice teachers who are able to
impact their school despite their inexperience by virtue of their technology expertise. These
beginning teachers “extended their influence beyond their classrooms by leading school-wide
technology initiatives and supporting their university peers in technology integration” (Gao et al.,
2010, p. 648). Thus, schools that provide opportunities for teacher collaboration and innovation
can benefit from the leadership that some teachers will exercise in sharing their mastery of
technology integration. In this manner, the TPACK of one teacher can positively influence that
of his or her colleagues, leading to positive school change.

Teacher-Leadership and Professional Development

Nothing has a greater impact on a student’s learning than the quality of the educator and
“a school system cannot exceed the quality of its teachers” (Barber & Moursheed, 2007). The next
section of this literature review examines research about teacher-leadership and professional
development. Any serious discussion of teacher development and teacher knowledge must be
informed by the seminal work of Shulman and his concept of the teacher’s “pedagogical content
knowledge” (1986). Shulman argued that in order to develop working theories about effective
content-specific pedagogy, teachers must integrate two bodies of knowledge: the discipline-
specific content knowledge of the field they are teaching and pedagogical knowledge about
effective teaching methods. Shulman termed this integrated teacher expertise “pedagogical-
content knowledge” or PCK (Shulman, 1986).

In another foundational work, Feiman-Nemser (2001) proposes a “curriculum for teacher
learning over time” (p. 1014) that addresses many of the shortcomings of typical teacher
preparation and support. At the core of this curriculum is the idea of a “professional learning
continuum” (Feiman-Nemser, 2001, p. 1014), reflecting the premise that teaching is a profession
to be learned over time. The continuum acknowledges that teacher development occurs in stages,
and all teacher learning must build upon previous learning. Teachers are learners at every stage of their career, with different learning needs at each stage. This is a novel approach to school reform. Rather than proposing alternative class structures, or new teaching strategies, the emphasis is on improving teacher learning, with the expectation that this process will encourage teachers to develop innovative new ideas that will effectively address the school’s needs and result in school transformation. According to Feiman-Nemser (2001), “If we want schools to produce more powerful learning opportunities on the part of students, we have to offer more powerful learning opportunities to teachers” (p. 1013). Feiman-Nemser’s (2001) “continuum of teacher learning” is a framework to improve teaching development at every stage of the teacher’s career, from pre-service training through beginning teacher induction to veteran teacher professional development. Feiman-Nemser (2001) proposes a complex and compelling curriculum for teacher development. The continuum for teacher learner presents rich learning opportunities for teachers at every stage of their development, and, more importantly, presents a fully integrated vision of the possibility of focusing on teacher development as a means to actualize school change and improve student learning.

Feiman-Nemser’s (2001) work continues to be highly influential on research on teacher training, support and professional development. For example, the Irish Teaching Council report on global teacher education used the guidelines proposed by Feiman-Nemser (2001) to assess what elements from the continuum of teacher development were present or absent from teacher training and induction programs (Conway et al., 2009). In their description of professional development to support teacher’s TPACK, Mishra and Koehler (2001) acknowledge Feiman-Nemser’s (2001) emphasis on new teacher development and their ‘repertoire’ of teaching techniques. Wood and Stanilus (2009) further confirm the wide influence of Feiman-Nemser’s
work, declaring that their “definition of quality teacher induction builds on the work of Feiman-Nemser’s (2001a) continuum of learning-to-teach” (p. 3).

Darling-Hamilton (2006) has conducted much research about how to improve teacher preparation. According to Darling-Hamilton (2006), successful teacher-preparation programs include all of the following key elements:

- A clear vision of good teaching.
- Standards of professional practice.
- A strong core curriculum.
- Extended clinical experiences.
- Extensive use of case methods, teacher research, performance assessments, and portfolio evaluation (p. 6).

**Teacher-Leadership**

The area of teacher-leadership has received considerable attention in recent years, as schools grapple with new methods to improve quality of teaching and learning. Searby and Shaddix (2008) describe the change in process involved in developing teacher-leaders as “moving from isolation to collaboration, from privatization of practice to open sharing of practice and from independence to interdependence” (p. 5). York-Barr and Duke (2004), in an extensive analysis of academic literature on the topic of teacher-leadership, note that there is not a consensus about the definition of the term ‘teacher-leadership,’ although most of the variations fall under pre-existing leadership theories. York-Barr and Duke (2004) attempt to redress this by proposing as definition that “teacher-leadership is the process by which teachers, individually or collectively, influence their colleagues, principals, and other members of school communities to improve teaching and learning practices with the aim of increased student learning and
achievement” (p. 288). One of the challenges in academic analysis of teacher-leadership, York-Barr and Duke (2004) point out, is that “teacher-leadership research continues to be idiosyncratic in nature, lacking an overarching conceptual framework and common or complementary theoretical underpinnings” (p. 287). Additionally, they argue there is more argument than evidence about the impact of teacher-leadership on student learning outcomes. The best-documented impact of teacher-leadership is on the experience of the teachers themselves, while there is “less empirical evidence [that] supports student, collegial, and school-level effects” (York-Barr and Duke, 2004, p. 288).

As teachers assume responsibility and leadership within a school, they become agents of change. Barth (2001) envisions teacher-leadership as a form of distributive leadership, with teachers assuming responsibility for making decisions about the structure of the school, involved in matters such as developing curriculum, determining the daily schedules, budget matters and teacher performance evaluations. Barth (2001) is a passionate advocate of teacher-leadership, unequivocally endorsing it as beneficial for students, because “Students learn where teachers lead” (p. 445). Teachers also benefit from leadership opportunities, Barth (2001) asserts, as they “experience personal and professional satisfaction, a reduction in isolation, a sense of instrumentality and new learnings – all of which spill over into their teaching” (p. 449). Barth’s (2001) article suffers from the weakness that York-Barr and Duke (2004) assert is common in much of the teacher-leadership literature – an abundance of theoretical ideas of how the concept should work and a distinct shortage of evidence of how teacher-leadership has actually worked. Nevertheless, Barth (2001) presents a clear, passionate and well-articulated rationale endorsing the broad adoption of teacher-leadership as a guiding principle in school organization.

Danielson (2006) defines teacher-leadership as:
That set of skills demonstrated by teachers who continue to teach students but also have an influence that extends beyond their own classrooms to others within their own school and elsewhere. It entails mobilizing and energizing others with the goal of improving the school’s performance of its critical responsibilities related to teaching and learning. (p. 12).

When teachers and others perceive teachers as leaders within a school, relationships change. According to Danielson (2006), teacher-leaders “develop a collaborative relationship with colleagues; they inspire others to join them on a journey without a specific destination” (p. 13). Teacher-leaders are valued both for their pedagogical knowledge as well as their understanding of the particular school community. The administration acknowledges “the greatest professional resource available to every school is the expertise of its teachers” (Danielson, 2006, p. 55). They contribute by participating with the administration in joint decision-making processes.

**Technology and Leadership**

The next section of this literature review examines some of the research on the intersection of technology and leadership. Langran (2010) writes about technology as an area of opportunity for teachers to exercise leadership. According to Langran (2010), “TRTs [technology resource teachers] in leadership roles have been able to act as change agents in schools, not only for technology integration, but in other district initiatives as well” (p. 164). Langram describes how technology integration can be the starting point for teacher collaboration, and then ultimately it can result in much broader changes to teaching and learning in a school.

Anderson and Dexter (2005) focus on the role of leadership in contributing to the success
of technology integration. Their focus is on positional leadership and the role that administrators, in their positions at the top of the school hierarchy, can play in supporting technology integration. They propose a model of ‘technology leadership’ with leadership as a mediating intermediary between the technology infrastructure and technology outcomes (Anderson and Dexter, 2005). They note that the factors of infrastructure and leadership are not isolated but in fact in relationship to each other – the leadership will be influenced by the technology resources present in a school, which may in turn cause the leader to allocate more resources towards technology infrastructure. For example, if a school principal observes an innovative example of technology integration using iPads in a 2nd grade classroom, he or she might decide to purchase iPads for all Lower School classrooms. Anderson and Dexter (2005), using this model, conclude that technology leadership has a bigger influence on technology integration in school than access to resources. This should serve as an important cautionary note to schools who are spending heavily on the latest gadgets that will soon become obsolete, rather than supporting technology leadership. Although supportive of distributive leadership, Anderson and Dexter (2005) caution that support for technology integration must also come from the school’s senior administration. For technology integration to impact a school, it must be fully integrated into a school’s vision, and supported with effective professional development, and this can only occur when the school administration exercises leadership in this area.

Youth and Technology

The digital generational divide, best articulated in Prensky’s (2001) concept of digital natives, can become very pronounced in schools that are led by digital immigrants. There is a tremendous threat to the credibility of teachers if their digital native students come to see school losing relevancy because the school has not kept pace with changes in the world occurring
Beyond the classroom walls. Spires, Lee and Turner (2008) explore this topic with a survey of student attitudes to and use of technology, in and out of school. In their focus groups, they discover that “the majority of students use a variety of technologies outside of school in authentic, personal, and social ways” (Spires, Lee & Turner, 2008, p. 506), even though they don’t see this reflected in their school experience. This assertion aligns with the finding of the Digital Youth Project, an in-depth analysis of teenage media usage, that discovers “teens are using online media to extend real world relationships, explore interests, express identities, and expand their independence and … [practice] new technical and social skills along the way” (Takeushi, 2012, p. 39). However, this study also reveals that fewer teens than expected were fully immersing themselves in new media in such a manner that they were expanding beyond their already existing community or knowledge base. This is a challenge to technology enthusiasts who argue schools must adapt simply to keep up with popular youth trends. Takeushi (2012) asks how children’s interaction with digital technology is mediated by gender, socioeconomic status, family values and cultural identity to show “young children’s access to and interest in technology are shaped by cultural, institutional, interpersonal and developmental forces” (Takeushi, 2012, p. 39). According to this argument, “digital natives are made, not born” (Takeushi, 2012, p. 39). These studies make clear the need to develop thoughtful pedagogical approaches to teaching children how to use the technological tools that they access so readily.

**Technology integration in social science**

While much has been written about the potential for digital technology in education to transform teaching and learning with grandiose visions, examining successes and challenges with technology integration in a particular teaching discipline is still worthwhile, allowing for accountability and a realistic assessment of the attempts to actualize technologies potential. This
section of the literature review explores research about technology integration in social science instruction. Mason et al. (2000) argue “Technology opens the door to learning social studies skills and content in ways impossible in the traditional classroom” (unpaged). The Internet, which allows for free and unlimited access to information, has transformed the process of historical inquiry, the heart of social science instruction (Wineburg, 2007). Students can conduct research with access to primary source documents that was previously unimaginable.

Hernández-Ramos and De La Paz (2009) explore the impact of “technology-assisted project-based learning experiences” (p. 154) on knowledge acquisition for eighth grade history students. Specifically, they are interested in whether student work demonstrates evidence of historical thinking, and also if the experience of learning history with integrated technology has an impact on the students’ attitudes toward learning history in general. They document how digital technology can be used to create an enhanced project-based learning experience for social science students. Although one might challenge whether these authors are in fact researching the impact of project-based learning rather than technology, the authors make a convincing argument that the project-based learning was only able to be effective due to the effective integration of technology into the unit by the teacher. According to Hernández-Ramos and De La Paz (2009), digital technologies “are uniquely capable of supporting rich, complex and nonlinear representations of knowledge and understanding” (p. 153). Thus, teachers who strive to teach in such a manner are able to exploit the technology to support these learning goals. Hernández-Ramos and De La Paz (2009) conclude that “students who completed the unit by working in cooperative groups to create multimedia projects, and who learned about content from each other, did in fact learn more than students in a comparison group who received instruction in a whole-class form of social studies instruction” (p. 162). Additionally, this experience had a
positive impact on attitudes toward learning social science and group work.

The potential impact of technology in the social science classroom is also evident in the transformation of traditional linear and static assignments to dynamic and multi-media creations. Heafner and Friedman (2008) uncover an increase in long-term retention of information in groups of students that collaborated online to create ‘wikis’ demonstrating their knowledge. These students did not do as well on the traditional end-of-unit test as the control group that completed the unit using the textbook and worksheet learning method, indicating the importance of aligning assessment with teaching goals and instructional methods. Several months after the completion of the unit, however, the students who created the wikis were better able to recall content information than the students in the control group. Heafner and Friedman (2008) argue that the collaborative tools of the Internet should be used to allow students to become “actively engaged in the subject matter in order to develop their own understandings and thus become generators of knowledge as well as active contributors to the Internet” (p. 300).

According to Doolittle and Hicks (2003), “That technology has a role to play in the fulfillment of social studies pedagogy is undeniable” (p. 86). They articulate a powerful justification for technology integration in social studies education, based upon constructivist pedagogy, arguing that technology such as the Internet opens up possibilities in the social studies classroom for teachers to allow their students to engage in authentic constructivist learning. Historical inquiry, which is at the heart of constructivist social studies teaching, is possible in a much more profound and authentic manner, thanks to the almost limitless access to information the Internet provides. Exploring epistemological and philosophical concepts about students’ historical knowledge, Doolittle and Hicks (2003) make the case that insofar as technology can be used to implement constructivist pedagogy in social science education, teachers have a
responsibility to learn how to do so effectively.

Doolittle and Hicks (2003) suggest a number of pedagogic strategies that show how technology can be used to support constructivist education. One strategy is using technology as a ‘tool for inquiry.’ Students can engage in authentic and deep research, using the Internet to access directly vast quantities of primary source documents. In this context, asking meaningful questions and then assessing information in order to identify accurate sources become high priority skills. Doolittle and Hicks (2003) argue that the Internet puts in the students’ hands the ability to engage in authentic inquiry and real-world action. The locus of expertise shifts from the teacher as source of all wisdom and authoritative answers. Hicks, Doolittle and Lee, (2004), based on their survey of high school social science teachers, conclude that far too few teachers were encouraging historical inquiry using access to primary sources on the Internet. However, more significantly, their data reveal that teachers were not using traditional teaching methods to analyze primary sources either. It would be of interest to determine if, in the almost-decade that has elapsed since the survey, the continued expansion of Internet access has been responsible for introducing more instruction using primary sources in social science classrooms.

Lee (2002) suggests a number of ways in which digital technology can be used in a social science classroom to support historical inquiry. Lee (2002) writes about digital history - “the study of the past using a variety of electronically reproduced primary source texts, images, and artifacts as well as the constructed historical narratives, accounts or presentations that result from digital historical inquiry” (p. 504). Digital archives give students access to unprecedented quantities of primary source documents. Searchable text associated with these documents gives students the ability to explore and analyze these documents in ways that were previously accessible only to experts in the field. This in turn transforms the learning experience. “When
students make decisions such as which document to use and how to use that document, they are constructing their own knowledge. … As students begin to put together discrete parcels of historical data they are constructing history” (Lee, 2002, p. 512). Lee’s (2002) focus was on student consumption of information. At that time Web 2.0 technologies were still nascent and possibilities for using digital technology for student output were limited. Today we see fluid interaction between the input and output of information. Internet users often shift back and forth between consumers and producers of online data. Lee’s (2002) argument is that access to digital resources is transforming the meaning of teaching history. Expertise is no longer stored exclusively in the textbook or the teacher’s head. The decentralization of knowledge represented by the Internet challenges traditional teaching modes, yet opens up new opportunities that support historical inquiry.

Waring and Bentley (2012) conducted research on historical inquiry when students were involved in creating content with new digital technology. They find “the act of constructing electronic-based historical profiles gave [students] an opportunity to conduct authentic historical inquiry and display the content learned in a variety of ways and through a medium with which they are largely familiar” (Waring and Bentley, 2012, unpaged). Students used notes they collected by researching historical characters to create fictional Facebook profile pages for their individuals. According to Waring and Bentley (2012), their findings “support the claim that history should be taught in dynamic, interpretive ways that require students to consider competing narratives … and that technology, in particular social media, can be used to do so” (unpaged). The project that Waring and Bentley (2012) describe is an example of innovating a traditional assignment using both the technology and the culture of 21st century youth. In place of a traditional biographical research essay, students create social media profiles for historical
characters. While the gesture of adapting an assignment into something that is more exciting to students is tempting for teachers interested in maintaining student motivation, Waring and Bentley (2012) demonstrate a more meaningful purpose to this technology integration. In order to fulfill the requirements of this assignment, students were required to engage in deep historical thinking by imagining what messages would be on the Facebook ‘Wall’ of their individual and who might be their friends.
Chapter 3 - Methodology

This research study sought to identify ways in which teachers can transform teaching and learning by integrating 21st century digital technologies. This study was Teacher Action Research, which is primarily a qualitative form of research. As a teacher action researcher, I was able to conduct research while maintaining my role as a practitioner (Holly et al., 2009). The research consisted of three technology interventions, conducted as part of an iterative cycle of research, reflection and revision.

Research Questions

How can teachers integrate digital technology into their teaching practice in order to transform teaching and learning?

Sub-questions:

❖ How can digital technology integration affect teachers’ knowledge and skills?
❖ How can digital technology integration affect content in the classroom?
❖ How can digital technology integration affect student learning?
❖ How can digital technology integration affect the relationship between the teacher, the student and the content?

These sub-questions are structured around the triangular ‘Instructional Core’ of learning (City, Elmore, Fiarman, & Teitel, 2009).

Research Approach and Justification

As a teacher, my research questions grow out of reflections on my students, my teaching practice and the remarkable changing context in which the teaching and learning occur. This research study is a direct response to a problem of practice that emerged as teachers grapple with
how to respond to the drastic social transformations caused by ubiquitous and rapidly changing 21st century digital technologies. While massive changes have transpired and continue to transform our society, I look at the students I teach every day in my classroom and wonder how these changes are impacting them, and what relevance this has for me as their teacher. These young adolescents are growing up in a world that is radically different than the one in which their teachers were schooled, and the only sure thing we know about the world for which we are preparing them is that technology will continue to cause radical and profound changes on the way in which we live, learn and work. I wonder what this means for me as a teacher and how these changes could or should impact teaching and learning in my classroom. According to Cochran-Smith and Lytle (1993), “the unique feature of the questions that prompt teacher research is that they emanate from neither theory nor practice alone but from critical reflection on the intersection of the two,” (p. 15). Thus, teacher action research was the most appropriate methodology for me to pursue this inquiry in my classroom. As a teacher-action-researcher, I was able to conduct research while maintaining my role as a practitioner, (Holly et al., 2009). I sought answers to my problem of practice both to advance the field and also to directly impact my own classroom teaching. Teacher action research allows one person to maintain this dual focus. As Trauth-Nare and Buck (2011) describe, “Through action research, teachers ultimately become researchers who contribute valuable practical knowledge of the realities of classroom ecologies which in turn informs the theory that undergirds educational research,” (p. 380).

While technology advocates in academia and private industry are developing products, curricula and even ‘21st century learning theories,’ there is still significant resistance to widespread and effective implementation of these ideas in classrooms. This creates a research opportunity that must be filled for schools of today and tomorrow to meet their vital educational
missions. I needed to conduct research in my classroom in order to actualize my role as an integrated research-practitioner.

**Research Design**

This study is Teacher Action Research, which is primarily a qualitative form of research. The research consists of three technology ‘interventions,’ conducted as part of an iterative cycle of research, reflection and revision. As classroom teacher and action-researcher, I both introduced and collected data about the impact of the three interventions. Throughout the research, I was constantly reflecting on the experience of the technology interventions and making changes to the research plans as necessary. Action research in particular requires careful recording of general observations on an on-going basis for the iterative aspect of the process to occur (Ferrance, 2000).

**Research Tradition**

Many advocates of teacher action research trace its origins to the work of educational pioneer John Dewey and his concept of learning from experience (Brydon-Miller et al, 2003). According to Cochran-Smith and Lytle (1993), Dewey, as a proto-action researcher, “urged educators to be both consumers and producers of knowledge about teaching – both teachers and students of classroom life” (p. 9). In 1946, psychologist Kurt Lewin, another giant in his field, coined the term when he published “Action Research and Minority Problems” in the Journal of Social Issues. Lewin (1946) advocated research that leads to action, using “a spiral of steps, each of which is composed of a circle of planning, action and fact-finding about the result of the action” (p. 40). For Lewin (1946), the activist nature of this research was fundamental. “Research that produces nothing but books will not suffice” (p. 43). In the 1950s, Stephen Corey (1953) applied Lewin’s concept of action research to teaching. Corey (1953) believed that if
teachers and researchers worked together to develop local knowledge in classrooms then there was a much greater chance that research outcomes would be applied by teachers rather than ignored as the product of out-of-touch academia. It took several decades, however, for this idea of meaningful partnership between teachers and researchers to gain wider acceptance.

Argyris and Schön (1991), both in collaboration and individually, published numerous articles that advanced the field of action research. Argyris (1995) contributed to the field the term ‘Action Science,’ which is most often applied in studies of organizational behavior. Schön (1983) proposed the concept of ‘reflective practice’ as an approach for teachers and other practitioners to learn from their professional experience. Herr and Anderson (2005) argued that, once Schön’s book *The Reflective Practitioner* “encouraged practitioners to begin to tap into their store of professional knowledge in order to make it explicit and share it with other practitioners, … it was only a short step to that of action research” (p. 22).

Much of the development of literature on action research in education, and specifically with teachers, can be attributed to the work of Cochran-Smith and Lytle (1993). Their ground-breaking publication *Inside/Outside: Teacher research and knowledge* articulated a conceptual framework for teacher action research, and demonstrated the power of such research by including numerous compelling pieces of teacher action research (1993). Their advocacy of ‘practitioner researchers’ was further developed in their subsequent publication *Inquiry as Stance*, (Cochran-Smith & Lytle, 2009). One of the more interesting updates in their new publication was the change in language from ‘teacher research’ to ‘practitioner research.’ Cochran-Smith and Lytle (2009) stated that this choice of terms was a very deliberate choice in an attempt to avoid the de-legitimization of action research in some academic circles that occurs when it is perceived to come from ‘mere’ teachers. They were clearly aware that despite the huge
advancements that have occurred in establishing the credibility of teacher/practitioner research, it still remains an underappreciated methodology amongst some researchers.

In describing practitioner inquiry, Cochran-Smith and Lytle (2009) proposed a number of key concepts that guided the current research study:

- Practitioner as researcher.
- Assumed links among knowledge, knowers and knowing.
- Professional contexts as sites for study.
- Emphasis on communities, networks and other forms of collaboration as the central structure that fosters and sustains inquiry.
- Blurred boundaries between inquiry and practice.
- New conceptions of validity and generalizability.
- Systematicity in terms of data collection and analysis.
- Efforts to make the work public (p. 118).

Cochran-Smith and Lytle’s (2009) key concept is ‘inquiry as stance’ which they described as “a grounded theory of action that positions the role of practitioners and practitioner knowledge as central to the goal of transforming, learning, leading and school” (p. 119). This was the stance I adopted when conducting research in my classroom. As much as I documented the impact of the technology interventions on my students, I also documented my experience as a teacher in the midst of these interventions. I paid careful attention to, and recorded my observations about what was or was not working and what surprised me about the student learning. This action research explored the development of my TPACK as I taught these lessons, and my thoughts about technology intervention in light of this experience.
Research Approach and Justification

In light of the research purpose and questions listed above, the most appropriate approach to conduct this study is Teacher Action Research. Action research is defined as “a participatory process concerned with developing practical knowing in the pursuit of worthwhile human purposes . . . It seeks to bring together action and reflection, theory and practice” (Reason and Bradbury, 2008, p. 4). Over the last decade, teacher action research, although still controversial amongst some academics, has received growing recognition as a valuable tool to develop knowledge about teaching and learning that contributes to both theory and praxis. Herr and Anderson argue, “unlike traditional dissertations that insist on a dispassionate, distanced attitude toward one’s research, action research is often chosen by doctoral students because they are passionate about their topic, their setting and co-participants” (Herr & Anderson, 2005, xvii). This approach resonates powerfully with my choice of topic and research methodology.

Participants

This teacher action research study took place in the researcher’s classroom. This is appropriate for the research tradition chosen because “with practitioner research, the borders between inquiry and practice are crossed, and the boundaries between being a researcher and being a practitioner are blurred” (Cochran-Smith & Lytle, 2009, p. 94). I teach 7th and 8th grade social science at a suburban private day school in a major city in the Northeast. According to school promotional material, it is “a community in which its students, parents and faculty find academic fulfillment, intellectual stimulation, Jewish meaning, and both personal joy and solace in one another” (school publication, undated). There are approximately two hundred students in the school. Many but not all of the students have been attending this school since kindergarten. With one class per grade, by the time they are in the middle school, the relationships among and
between the students are very close. They have sibling-like relationships with their classmates, and the families enrolled in the school are a tight-knit community. Even with a generous financial aid policy (57% of families receive tuition assistance), the cost of tuition leads to a student body that tends to come from very well-educated middle- and upper-class families. Many of the parents are academics or other white-collar professionals, and they expect their children to be high achievers as well. By the time they are in middle school, students have internalized the dominant socio-cultural values that education, intellect and hard work are important. They understand that, when the time comes, they are expected to be admitted into and succeed at a well-ranked university. Over 50% of graduates continue at a private high school. In addition to high academic standards, the school has a child-centered focus, emphasizing differentiated instruction and seeking to meet the individual academic and social needs of each student. There are a number of students on support plans to help with academic and/or social challenges. In this sense, every classroom is an ‘inclusion classroom.’

**Sampling Strategy**

There were 21 students in the seventh grade class. The sample strategy involved ‘intervention experiments,’ described by action research pioneers Argyris and Schön (1991) as “experiments that bear the double burden of testing hypotheses and effecting some (putatively) desired change in the situation” (p. 86). The interventions consisted of integrating technology into classroom teaching and learning. Students completed pre- and post-intervention surveys. As the researcher, I collected student work samples, a valuable form of data collection and analysis. In order to help maintain the distinction between the overlapping roles of teacher and research, I recorded notes in a “reflexive journal” (Guba and Lincoln, 1982, p. 248). In between the second and third interventions, I reflected on the experience of the previous technology interventions, in
partnership with teaching colleagues, in a Collaborative Assessment Conference. Feedback from my teaching colleagues was very helpful in designing the third technology intervention. This allowed the iterative nature of teacher action research to occur.

**Recruitment and access**

My research site was the classroom at the school where I teach. I am fortunate that the school administration was supportive of my dual role as researcher-teacher; they gladly consented to my proposal to use the classroom as a research site. As a classroom teacher, my study participants were a pre-determined group of individuals. However, according to the Belmont Report, children’s participation in a study must be achieved by receiving positive permission from the child, known as ‘assent,’ in addition to a parent or legal guardian’s permission. Thus, in order to fulfill the ethical and legal requirements of the Belmont Report, the researcher must ensure that both parent and child agree to the child’s participation in the study. It is important that students do not feel coerced to participate in the study because the researcher is also their teacher. I made clear to students and parents that participating in the study had no impact on class grades. Additionally, all students, whether or not they agreed to be part of the study, were still required to participate fully in all classroom activities and assignments. In order to relieve pressure from students, I emailed information about the study directly to parents. This gave families the opportunity to discuss in private whether or not they wanted to be part of the study, without fear of being overheard by me or a colleague. If either the parent or child did not want the student to be in the study, they did not return the signed papers, and I do not know if it was the student or their parents that refused. Thus, students should not have felt obligated to assent to participate in the study if they did not feel comfortable doing so.

Confidentiality and anonymity were achieved by assigning each student a pseudonym.
All student responses were recorded according to the pseudonyms and all identifying features were removed. The students’ participation in this study did not impact their relationships with each other or with their teacher.

**Data collection**

Data was collected from multiple sources:

- Pre- and post-intervention surveys completed by students for each intervention.
- Student work samples.
- Collaborative Assessment Conferences with teaching colleagues (Seidel, 1998).

Herr & Anderson (2005) argue “action research is a messy, somewhat unpredictable process, and a key part of this inquiry is a recording of decisions made in the face of this messiness” (p. 78). Thus, an important source of data was the field notes I recorded after each lesson. The observations and reflections of the teacher-researcher on the impact of the technology integration on the teaching and learning in the classroom were crucial data points. In this manner, the ‘messiness’ was documented and made central to the inquiry. Student work was collected, and was also an important source of data, but this inquiry sought to uncover not just the impact of technology on students’ finished product, but also on the process behind the production.

Teaching colleagues analyzed student work in a Collaborative Assessment Conference using protocols designed by Seidel (1998). Before the conference, as researcher I reviewed all student work and selected three representative samples. Then teaching colleagues conducted a Collaborative Assessment Conference to examine closely the selected student work. According
to Seidel et al (1997), using this protocol “can, sometimes quite significantly, change the way teachers think about children and their work, assessment, and learning” (p. 75). One teacher served as the facilitator of the session, responsible for keeping track of time and ensuring all participants stay on the appropriate phase of the protocol. The researcher served as the presenting teacher, while the other teachers were the readers, responsible for reading and discussing the student work. The five steps in a Collaborative Assessment Conference were as follows:

1. Each teacher carefully and silently reads or observes the student work.

2. The readers share their thoughts about the student work, while the presenting teacher remains silent. This step is broken-up into three phases. The first phase is descriptive, with readers sharing observations of what they see in the work. In the second phase, the readers ask whatever questions the work raises for them. In the third phase, readers speculate on what the student may have been working on in the artifact they are examining.

3. The presenting teacher, who has been silent until now, speaks, responding to the readers’ comments. The presenting teacher may share more information about the student and the assignment, or answer any of the questions the readers raised previously.

4. In the Seidel model, at this stage, all participants discuss possible next steps in the classroom to support and challenge the student, based on the analysis of the work. However, for the purpose of this research, this stage was adapted, and the focusing question was how the use of technology for this assignment impacted teaching and learning, based on the student work.

5. The conference ends with a reflection on the session itself (Seidel et al, 1997).
An adapted Collaborative Assessment Conference protocol, as mentioned above, was used to structure the teacher meeting. An important aspect of the protocol was that as the teachers analyzed the student work, questions emerged about the student and the work that was created. The questions that emerged from these sessions provided valuable guidance for the researcher. Additionally, this form of conference was a very structured way to have ‘another pair of eyes’ take a look at the work. As the classroom teacher that created the assignment, explained the project to the students, answered their questions about the project, and then helped them complete it, I may not have noticed aspects of the work that were obvious to the outsiders who were unfamiliar with the process of creating the work. It was difficult for me to observe the work without making interpretations based on my experience with the students. This was what made the Collaborative Assessment Conference so valuable for this research. The insights of the other teachers helped me as a researcher uncover aspects of the students’ work that I overlooked.

The protocol of the conference was specifically designed to bring out these elements from the other teacher ‘readers.’ The initial reading took place with complete decontextualization of the student work. The teachers described simply what they saw in the student output. This was helpful for me in trying to assess the role of technology on student learning. The teachers looked at the students’ assignments, without knowing how I hoped the technology might support the learning.

I maintained a ‘reflexive journal,’ as described by Lincoln and Guba (1982) - a record of my own observations, questions and initial interpretations as they developed over the course of the data collection stage. The journal acted as a form of self-check, holding myself accountable on an on-going basis to the research questions and keeping me aligned with the purpose of the study. Thus, I was able to be “practicing reflexivity … attempting to uncover one’s underlying
epistemological assumptions, reasons for formulating the study in a particular way, and implicit assumptions, biases, or prejudices about the context or problem” (Guba & Lincoln, 1982, p. 248).

**Data storage**

All data was saved in a password-protected Dropbox online storage account. Only the researcher and his faculty advisor had access to this account. Names of all students were recorded using only pseudonyms. A master list of student names and pseudonyms was kept in printed form in the researcher’s home office. It was never brought to school. A copy of this list was given to the faculty advisor, to ensure back up. Upon completion of the research, all files from the Dropbox were removed and stored in a compressed file format on a thumb drive. This will be saved for seven years and then destroyed. Confidentiality for all these files was maintained by avoiding opening the research files while at school.

**Data Analysis**

Much of data analysis in teacher action research is similar to other quantitative research, however the defining aspect, as is true with all forms of action research, is the iterative process. Data in this project was analyzed in-between each technology intervention. The analysis then informed the subsequent intervention. Within each stage of analysis, many aspects were common to more typical qualitative research.

In the first phase, initial coding occurred. The coding stage was fundamentally important to the research study, as it defined how the data is ‘seen’ and thus understood. Of particular significance in teacher action research, this coding then also helped shape the nature of the second and third actions in the classroom. It included data from student work, notes from the teacher-researcher’s ‘reflexive log,’ and notes from the teacher Collaborative Assessment
Conference. The use of multiple sources allowed for triangulation of data (MacLean and Mohr, 1999).

The researcher transcribed audio recordings of the teacher Collaborative Assessment Conferences. Data was coded using a general inductive approach. Using an inductive approach, the researcher began transcript analysis with “close readings of text and consideration of the multiple meanings that are inherent in the text” (Thomas, 2006, p. 241). According to Thomas, when applying the general inductive approach, the purpose of this step was to identify “the core meanings, evident in the text, relevant to evaluation or research objectives” (Thomas, 2006, p. 241). This approach was used to analyze the transcripts.

The next stage in coding was the “creation of categories” (Thomas, 2006, p. 241). As passages were reread, connections were made between different sections, and broad categories assigned to specific remarks. The aim was to achieve “themes or categories most relevant to research objectives identified” (Thomas, 2006, p. 241) as the outcome of this analysis. Transcripts were marked-up using the concept of ‘pre-coding’ (Layder, 1998, cited Saldana, 2009, p. 16), which Saldana described as “circling, highlighting, bolding, underlining, or coloring, rich or significant participant quotes or passages that strike you” (Saldana, 2009, p. 16).

Descriptive coding, as described by Saldana (2009), was the primary coding framework applied to this data. “Descriptive coding summarizes in a word or short phrase – most often as a noun – the basic topic of a passage of qualitative data” (p. 70). Descriptive coding was selected, among other reasons, because it “is appropriate for virtually all qualitative studies but particularly beginning qualitative researchers learning how to code data” (Saldana, 2009, p. 70). In keeping with general inductive analysis practice, categories were determined based on the labels generated by the coding.
Following the initial coding, the next stage of analysis for the researcher was axial
coding. The axial coding stage was an important transition in the process of inductive analysis.
In axial coding, the open categories that were developed in the first stage of coding became very
significant. Rather than sifting data with no preconceived notions, the findings from the first
transcript served as a framework with which to examine the new data (Creswell, 2007). Analysis
of the new transcripts either confirmed that the original categories were meaningful or suggested
other labels to organize the data. According to guidelines suggested by Strauss and Corbin (1990,
cited by Creswell, 2007), the axial stage was the “theorizing part of grounded theory … when the

The coding process described above occurred after the completion of the first technology
intervention. As terms emerged from the coding, I gained language to use when introducing the
second technology intervention. Additionally, my findings and observations from the first
intervention informed choices I made about the subsequent technology interventions. In this
manner, the iterative process of teacher-action-research occurred.

Notes from my reflexive log were an important way to crosscheck the data. Once I
determined codes from the student and teacher transcripts, I returned to my log to identify if I
used any similar language in my observations of what was happening at the time. At this stage,
the log was an important record of my thinking at each particular moment in the study.
Inevitably, as both teacher and researcher, my thinking was influenced by what I experienced in
the classroom and also what I noticed after the fact from analyzing the data. I looked for areas in
my notes where I overlooked important developments that were occurring in the classroom in
regards to the impact on teaching and learning of the technology integration. This was how I
could reflect on my emerging TPACK.
As a teacher-researcher, when analyzing data I did not have to bracket my teacher knowledge and experience. In contrast, my expertise as a teacher drove the data analysis. In Cochran-Smith and Lytle’s description (1993) of data analysis in teacher action research, “teachers use the interpretive frameworks of practitioners to provide a truly emic view that is different from that of an outside observer,” (p. 18). Accordingly, I brought what I knew about these students, the assignments and the teaching context to the data as I analyzed it.

**Trustworthiness**

The findings of a research study were only as valuable as the quality of the methodology while the study was conducted. The term ‘trustworthiness’ has been applied to describe the assessment of the quality of a study. Readers of a study need to be able to trust that a study reflects some essential truth, rather than, in the contemporary euphemism coined by comedian Stephen Colbert, ‘truthiness.’ On this basis, qualitative methodologies have often been attacked and undermined by rational or positivist academics that charged the studies lacked reliability and validity. Guba and Lincoln (1982) disarmed this critique, however, by proposing alternate benchmarks that can be used to assess qualitative, or naturalistic studies on their own merits, rather than analyzing such studies through inappropriate positivist frameworks, in which they are inevitably found wanting. Trustworthiness of qualitative research, Guba and Lincoln (1982) suggest, can be achieved by adherence to “new criteria that are more appropriate and of approximately equal power in differentiating good from bad, inadequate or untrustworthy research,” (p. 246). They reframe the criteria as follows:

a) Credibility, in preference to internal validity.

b) Transferability, in preference to external validity/generalizability.

c) Dependability, in preference to reliability.
d) Confirmability, in preference to objectivity (Guba & Lincoln, 1982).

In the following paragraphs, this research proposal describes the efforts that were taken to actualize each of those criteria such that the study maintained trustworthiness, following Guba and Lincoln’s (1982) recommendation that “a naturalist design ought at least to propose what the inquirer will do to satisfy each of the above criteria and provide for trustworthiness” (p. 248).

**Credibility** refers to how accurately the reality of the study participants is represented in the study. In this understanding, “the crucial question … becomes, ‘Do the data sources (most often humans) find the inquirer’s analysis, formulation, and interpretations to be credible (believable)?’” (Guba & Lincoln, 1982, p. 246). Member-checking - “whereby data and interpretations are continually checked with members of various groups from which data are solicited” (Guba & Lincoln, 1982, p. 247) - was an important step in the research. Accordingly, I shared observations and initial findings with the students participating in the study after each stage of the technology interventions. The emphasis was on sharing how I perceived the students’ experiences, in order to confirm with the participants whether or not these perceptions were accurate interpretations.

Peer scrutiny is another valuable technique to achieve credibility. This is central to teacher action research, not an after-thought. After two of the three technology interventions in this study, I invited teaching colleagues in my school to participate in a Collaborative Assessment Conference (Seidel, 1998) in order to gain their insights on the impact of the technology on student learning. Additionally, on an on-going basis, I turned to my colleagues as ‘critical friends’ (Lomax, Woodward, Parker, 1996) to help me reflect on what I was noticing and wonder about what was occurring in my classroom. Shenton (2004) credits Miles and Huberman for clarifying that credibility requires the researcher to acknowledge the researcher’s
personal bias. This was an example of how the structure of teacher action research contributes to trustworthiness. Instead of trying to bracket my experience, I situated myself as a teacher-researcher and both of those titles – teacher and researcher – were important.

This study applied two additionally overlapping strategies that were helpful in achieving credibility: “prolonged engagement,” and “persistent observation” (Guba & Lincoln, 1982, p. 246). Prolonged engagement involved the researcher building in-depth relationships with the individuals in the study site over a long period of time. Persistent observation referred to observing the subject with sufficient depth so as to be able to distinguish typical and atypical behavior, before the study interventions occur. This study took place toward the end of one school year and continued with the same students after summer break. As a result I was very familiar with the students and the school context in which they were learning. I have taught in the school where the study took place for over 10 years and have taught many older siblings of my current students. Additionally, I taught many of these students several years ago in kindergarten. The students and their families knew me and I knew them.

Transferability - In rationalistic research, researchers strive to prove that their study has external validity or generalizability. According to this concept, the study contributes to the field because the research findings uncover a truth that is not just true in the isolated context of this particular study, but because the careful conditions in which the study occurred can be reproduced in other situations. Thus, the truth of the study is valid beyond the research site and the particular finding can be generalized to a universal truth. Guba and Lincoln (1982) argue that it is not possible to authentically isolate any knowledge from the context in which it is generated. However, they recognize that for a study to be of any interest to a broader audience than simply the researcher, there must be some avenue to think about how to apply the findings to another
context. With this in mind, they suggest ‘transferability’ as a more appropriate criteria for qualitative research than generalizability (Guba & Lincoln, 1982, p. 247). Transferability refers to the possibility of a reader of the research transferring the findings of a study to another context. “Findings are not generalized, but rather transferred from a sending context to a receiving context” (Anderson, Herr & Nihlen, 1994, p. 33). Significantly, the onus to determine the broader application of the findings shifts from the researcher to the reader. According to Lincoln and Guba (1985), “if there is to be transferability, the burden of proof lies less with the original investigator than with the person seeking to make an application elsewhere” (p. 298). In order to achieve this level of transferability, there were several elements that the research must include to allow for the possibility of a reader actualizing such a transfer. A crucial step was including sufficient details of the study. According to this concept, while the researcher was not required to explain how conclusions that emerge from the data would be expected to emerge from other data as well, the research needed to include “thick description” of all elements of the study, “providing enough information about a context, first, to impart a vicarious experience of it, and, second, to facilitate judgments about the extent to which working hypotheses from that context might be transferable to a second and similar context” (Guba & Lincoln, 1982, p. 247). These details allowed a reader to attempt their own study, transferring the elements from this research. Thus, for my study to achieve transferability, I strove for thick description of all aspects of the study. Fortunately, this approach aligned well with the methodology. Such description was vital to teacher action research. In conducting this research, I was interested not just in the findings, but also the process. The cyclical nature of teacher research required documenting each step of the research. In order to maintain transferability, I documented thoroughly my teaching, student work, the context in which the teaching and learning was occurring and the methods
employed to collect data.

**Dependability** - The concept of reliability is applied in rationalist research to mean that another researcher could conduct the same experiment and the same data would emerge. Lincoln and Guba (1982) challenge this approach by emphasizing the uniqueness of every context in which a qualitative study occurs. The same data could not be reproduced, they argue, because another researcher would inevitably and necessarily make changes to the study design as it occurs. Rather than strive for the unobtainable criteria of reliability, they propose that researchers should emphasize the dependability to their data, meaning that once the study is conducted there is stability to the findings. Dependability is primarily achieved in a similar manner to transferability, with a strong emphasis on including detailed description of the study. Thus, as described above, this study included thick description. Shenton (2004) emphasizes that in order to support dependability, this description should “enable readers of the research to develop a thorough understanding of the methods and their effectiveness” (p. 71). This study followed this recommendation, including sections describing the design and implementation of the research, the process of collecting data and the researcher’s reflections on the effectiveness of the inquiry methods.

**Confirmability** - Guba and Lincoln (1982) replace the rationalist methodology criteria of objectivity with confirmability. They propose a shift in focus from the researcher to the data, because “it is not the inquirer’s certifiability we are interested in but the confirmability of the data” (p. 247). In order to achieve this shift in focus, “steps must be taken to help ensure as far as possible that the work’s findings are the result of the experiences and ideas of the informants, rather than the characteristics and preferences of the researcher” (Shenton, 2004, p. 72). One strategy in this process is triangulation of data - “mak[ing] use of multiple different sources,
methods, investigators, and theories to provide corroborating evidence” (Creswell, 2007, p. 208). As mentioned above, triangulation was achieved by collecting data from student responses on questionnaires, analysis of student work, teacher responses from Collaborative Assessment Conferences and field notes from the researcher’s reflection journal. The field notes were also an indication of the “self reflexivity” that were integral to the study, an additional strategy Guba and Lincoln (1982) propose to achieve confirmability and reduce investigator bias. I recorded notes immediately after each lesson in a “reflexive journal,” in order to, as they suggest, “undercover one’s underlying epistemological assumptions, reasons, for formulating the study in a particular way, and implicit assumptions, biases, or prejudices about the context or problem” (Guba and Lincoln, 1982, p. 248).

The intention of describing the above efforts was to achieve trustworthiness following the guidelines proposed by Guba and Lincoln (1982). It was hoped that these paragraphs would indeed “assure the consumer of such research that any and all appropriate steps have been taken to assure that data from human sources and contexts are meaningful, trackable, verifiable, and grounded in the real-life situations from which they were derived” (Guba and Lincoln, 1982, p. 250).

**Protection of Human Subjects**

As I conducted teacher action research in my middle school classroom, the participants, as minors, could be considered a vulnerable population. Vulnerable populations require special protections in order to ensure the three principles identified in the Belmont Report are maintained. Subpart D of the Belmont Report identifies children as a group that requires special protection because they are considered by virtue of their youth to have ‘diminished autonomy.’ This status compromises their ability to provide “legally effective informed consent.” According
to the NIH, “The ages, maturity and psychological states of the children involved in the research should be taken into account when determining whether children have the capacity to assent” (NIH, 2011, p. 55). In this study, the students were seventh and eighth grade students, aged 12 to 14. It was reasonable to assume that they were sufficiently mature to make assessments of the risks involved in this study of their learning.

Another complicating factor of using these students for my research falls under the Belmont principle of respect for persons. I needed to ensure that I avoided any possible perception that participation or non-participation in my research would impact student assessments. It was possible that students could have felt obligated to participate in the research out of fear that opting out could have a negative impact on their grade for the course. I did not believe there were any significant negative consequences from participation in my research. The nature of teacher action research is that the teacher continues to teach for all students. The only significant difference for the students was that the teacher focused particular energy on observing certain aspects of what was occurring in the classroom. It was possible that misconceptions about the nature of my research could have caused anxiety or other concerns for students. One way I sought to overcome this issue was transparency about my research with the students. As I collected data about the impact of technology on the learning in my classroom, I shared some of my observations with my students. This was also a form of member checking of the data, to see if the students agreed with my analysis of their experience. A secondary purpose of this sharing was to allay student fears about the nature of my research. This was a way to ‘lower the stakes’ for the students about their choice to assent to participate in my research and confirm that whether they participated did not impact their grade in the course.

This chapter has described the methodology that was employed to conduct the qualitative
research study. This research study sought to identify the ways in which teachers can transform teaching and learning by integrating 21st century digital technologies into their teaching practice. Using the framework of the Instructional Triangle (City et al., 2009), the research explored the impact of technology integration on teachers’ knowledge, student learning and content in the classroom. This qualitative study focused on the experience of one teacher in one classroom; the practitioner was also the researcher, which was why teacher-action-research was employed. This chapter described in detail the methodological steps that were undertaken to explore the research questions with integrity and enthusiasm. Three technology ‘interventions’ occurred as part of an iterative cycle of research, reflection and revision. The researcher adopted a stance of inquiry (Cochran-Smith & Lytle, 2009), exploring the impact of the technology on teaching and learning in the classroom.
Chapter 4: Research Findings

Introduction

The world in which children are growing up today is radically different than that in which their teachers came of age. Yet too many Jewish day school students are still learning in schools that were designed to train them to be part of the workforce of the 20th century. There is a need for rigorous academic research that identifies how digital technology can be deliberately and effectively used to address this shortcoming. The purpose of this study is to identify the ways in which teachers can positively transform teaching and learning by integrating 21st century digital technologies. This chapter describes the procedures of teacher action research that were executed in order to conduct this study, including both the teaching of the units as well as the data collection. The chapter includes analysis of the data that were collected in the teacher-researcher’s classroom during the course of the study.

Research Questions

The following research questions guided this qualitative teacher action research study:

How can teachers integrate digital technology into their teaching practice in order to transform teaching and learning?

Sub-questions

• How can digital technology integration affect teachers’ knowledge and skills?
• How can digital technology integration affect content in the classroom?
• How can digital technology integration affect student learning?
• How can digital technology integration affect the relationship between the teacher, the student and the content?
The sub-questions were structured around the triangular ‘Instructional Core’ of learning (City, Elmore, Fiarman, & Teitel, 2009).

**Data Collection and Results**

This study was conducted in the teacher-researcher’s seventh and eighth grade social science courses during the spring and fall semesters of 2013 at the Benderly Jewish Day School, an elementary Jewish day school in the Northeast. The seventh grade students in the spring semester matriculated to eighth grade for the fall semester, continuing with the same teacher and thus were able to continue participation in the study.

The class consisted of 21 students, all of whom were invited to participate in the study. The research was conducted with 17 students who received parental consent and gave their own their assent to be part of the study. There were seven boys and ten girls. The families who sent their children to Benderly were interested in providing their children a rigorous Jewish education. The school was proud of the diversity of Jewish practice within the community. Despite the diversity, Jewish commitment was highly prioritized by the entire community. Benderly families demonstrated this commitment both in financial terms, by paying tuition, and by participating in the school community. The school population tended to be highly educated. Parents were largely employed in white-collar professions such as higher education, Jewish communal life, medicine or high tech, and there was a clear expectation throughout the school that these students would follow the footsteps of their driven and high achieving parents. Already in middle school, the students had internalized their parents’ emphasis on education as the key to social and professional advancement. After six plus years of enrollment at Benderly, many of these students’ parents had paid well over $100,000 on tuition, significantly more for families with

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2 All names in this paper are pseudonyms, including the name of the school and the students.
multiple siblings. Most of the students were highly motivated learners, some because they were aware and curious about the world in which they live, and others simply because they understood the expectation that they should excel at school. The study participants were all American born. Three of them had parents born in another country.

Student attitudes and experience levels with technology were explored using a survey that was administered to the students before the classroom technology interventions occurred. The goal of the survey was to better understand students’ attitudes and comfort levels with digital technology in general and specifically for learning. Some questions were derived from Ben-David Kolikant (2009), a survey that asked digital native students’ about their attitudes toward classroom learning, with a particular emphasis on history instruction, as well as how they used technology in their leisure time. In responses to the current research survey, 73% of student respondents said they were ‘very’ or ‘extremely’ comfortable with technology. When asked how confident they were using digital technologies to solve a problem or find answers to questions that mattered to them, over half of student respondents selected ‘very’ or ‘extremely’ confident. This indicated that the students in this study had significant experience with technology, and were indeed growing up as “digital natives” (Prensky, 2001). Their responses about specific digital technologies indicated a wide range of experience, perhaps indicating that while these students spent significant time with technology, their online experiences were far from uniform. They had fairly limited experience with social media such as Facebook and Twitter, but they were all very experienced watching and sharing YouTube videos and many were self-identified text message experts. Only a few students experienced creating and sharing videos or music online. While all students were at least minimally competent in creating documents on GoogleDocs and reading news and entertainment online, there was a significant range of levels
of experience with video games and computer programming, including a few students who were complete novices. There was a range in how positive the students viewed technology in their learning, yet they all more or less seemed to take technology for granted. In the survey, all respondents said they would be likely to use digital technology to help with writing an essay, conducting research or learning new information. Generally speaking, these students liked going online. They used digital technology as a source of entertainment, a way to communicate with friends and were accustomed to using technology to complete assignments for school. There were a few students with particular interests in video games, programming and creating and sharing music or videos, but this was hardly a dominant trend in the class. For complete survey responses, see Appendix A.

The study began in my seventh-grade course in the spring of 2013. The class met for three 50-minute periods each week. All students participated fully in all coursework and classroom activities, regardless of their participation in the study. However no data was collected on the four students who did not participate in the study. I did not record observations about these students in my reflective log and the work they produced was not included in the student work that was analyzed for the study.

*First Technology Intervention: American Revolution Digital Project*

According to Guba and Lincoln (1982), rich description is necessary in teacher action research in order to maintain validity. Thus, the technology interventions that were attempted for the purpose of this study will be described in detail. Emphasis in this section is on the teacher’s learning goals for the students and the activities in which the students were engaged. In a later section, the data collected during these interventions is analyzed.
For the first technology intervention in this study, students were given an assignment to answer one of five essential questions about the American Revolution. This was the concluding section of the yearlong seventh-grade revolutionary history curriculum. My goal, as the teacher, was to use these questions as a final assessment of the students’ learning of course content. They were very broad questions, requiring synthesis of information that I hoped students learned over the course of the year. Student answers to the question of their choice were the final assessment of their learning. The students had to choose to answer one of the following questions:

- Why do people rebel against their government?
- When do people have the right to revolt against their government?
- Who were the people that made all the difference?
- What event was the turning point?
- What ideas caused conflict between Great Britain and the American colonies, and led to the Declaration of Independence?

In order to complete this assignment, students were required to complete a number of steps. They were each given access to a unique online ‘research notebook’ in the form of a GoogleDoc with a template that included tables to be completed. The first step was to meet with other students who chose to answer the same question and make a list of sub-questions they needed to answer in order to be able to thoroughly address the overarching question. This list of sub-questions framed the research each student had to conduct to answer the question. When students had completed the note-taking portion, they had to create a visual representation of how they wanted to answer the question, using a graphic organizer called a ‘Brain Frame’ that they are familiar with due to its use across the school. Students had the option of creating their Brain Frame on paper or using the online program ‘Popplet.’ The next step was to answer the question,
First in writing and then in digital form. The results of the student work on this assignment are discussed below.

**Second Technology Intervention: Constitutional Convention Presentations**

The second technology intervention in this study was part of a Constitutional Convention simulation. Using materials adapted from a Zinn Education Project curriculum, students took on the role of delegates to the Constitutional Convention of 1787, with emphasis on Americans who were not included in the original convention. Thus, in addition to white northern merchants and southern plantation owners, groups represented at this convention included women, white indentured servants, native Americans and both enslaved and freed African-Americans. After learning about the issues facing the young nation at the time of the constitutional convention, students were assigned one of the interest groups, based on their personal preferences. There were seven groups of three students each. Each group was given a package of information about their specific group, indicating some of the relevant issues for that group in 1787. The students received invitations to attend the class convention where they would write the new constitution, specifically the sections about slavery and suffrage. Each group was required to write constitutional resolutions and develop presentations that answered these questions:

- Should slavery, as well as the entire slave trade, be abolished, and should escaped slaves be returned to their owners?
- Who should be allowed to vote in our new nation, and especially what role should gender, race and property ownership play in such a decision?

Students worked in groups to write resolutions, to be presented at the constitutional convention, that expressed an appropriate response to these questions based on who they were representing. Additionally, each student was responsible for writing an individual speech that
would introduce their character and express their character’s beliefs about one of the issues. This speech was written as if it was going to be read aloud to the convention. But in order to make the best use of limited class time, students submitted their speech as a written assignment and their resolutions were digital presentations that were shared with the class during the convention role play. Each group presented their resolution, followed by debate from the convention. Groups were encouraged to develop alliances with other groups in order to get their resolutions passed. The students were aware of this aspect of the presentation and a requirement of the digital presentation assignment was to make a clear appeal directly to other groups, indicating the reasons why they should support the resolution.

Students created their constitutional convention presentation in the digital form of their choice. They were given a rubric that made clear the expectations for this assignment. According to this rubric, to earn an A, the digital project had to include:

- Well written resolution text, organized in logical order with focused and coherent sentences.
- A strong, well-defined position with supporting arguments that appeal to the audience.
- Compelling multimedia (images, music, audio and/or video) that make the argument more powerful.
- Attractive and organized layout.
- No errors in punctuation, capitalization or spelling.

Other than the requirement for multimedia that explicitly supported the argument, there were no specific technology requirements for this assignment. Technology was to be used as a tool to present ideas to an audience. Thus, students were assessed on the effectiveness of the persuasive argument shared in their presentation. They were not being encouraged to use
technology simply for its own sake, but only to be an effect medium. It did not matter if students learned how to change the color of the text or include video, unless this technique improved the impact of the presentation on its intended audience. An implicit goal of this assignment was for students to develop their understanding of the potential for digital technology to create content and expand their toolbox of media in which they were competent to communicate.

Before students created their presentations, they saw a sample presentation created by the teacher, using text from the actual constitution that consisted of a slideshow made with Google Slides. This presentation included multiple images as well as arguments that appealed directly to specific interest groups.

The learning goals of the constitutional convention unit were for the students to understand how the text of the American constitution that was passed at the Constitutional Convention of 1787 represented the values of the men who attended the convention, and that the exclusion of many Americans was reflected in how the constitution addresses or ignores issues of suffrage and slavery. Students engaged in experiential learning by role-playing representatives at the constitutional convention, gaining a deeper understanding of the process by which the constitution was written. Students reflected on how some Americans benefited from the provisions of the U.S. constitution while others suffered. By writing and presenting constitutional resolutions and engaging in debate to support their resolutions, students saw themselves as part of the dynamic process of creating and re-creating American democracy, making connections between history and contemporary political issues.

**Third Intervention: Bill of Rights Computer Program**

The third technology intervention under examination in this research study was Scratch computer programs designed by students to teach about the contemporary significance of the Bill
of Rights. The study of the Bill of Rights unit was a natural continuation of the constitutional convention unit described above. After a brief historical overview of the events that led to the Bill of Rights, the focus of study shifted forward chronologically, examining landmark court cases and contemporary issues that involved constitutional rights. The final assignment for this unit was to develop a computer program that would teach users about one of the specific rights enumerated in the Bill of Rights. The assignment description given to students included the following:

**Know Your Rights!!**

**Assignment:** Teach your classmates and other Americans about their constitutional rights.

You will be assigned one of the amendments from the Bill of Rights. You will need to learn and then teach what this amendment means today.

You will conduct research to determine:

- **Key court cases** that have determined how the language of the amendment, written in 1787, is applied understood and today.
- Where and how we see that right exercised or restricted in America today.
- How America would be different without this right.

**Final project:**

- Create a Scratch program that illustrates the right today. The program can be a quiz, a game or an animated story.

Before students started their computer program, they answered questions in their ‘Research Notebook,’ a GoogleDoc that contained the following questions:
- Amendment text.
- Amendment language in easy-to-understand language.
- Important court case.
- How did the ruling in this case impact the meaning of the right today?
- Where do we see this right exercised today?
- Where do we see threats to this right today?
- How would life in America be different without this right?

This step was a requirement in order to ensure that students had a clear conceptual understanding of the right and sufficient and accurate content to include in their program before they faced the challenges of computer programming.

The goals of this assignment were for students to make a connection between the history of the writing of the Bill of Rights and the world in which they live today, and to understand that the rights that Americans have today were a result of the language of the Bill of Rights as written in 1787 and over two centuries of jurisprudence. Students would become teachers and thus reflect deeply on the significance of these rights today, for themselves and for other Americans. Computer programming was selected for this assignment as a way for the students to delve deeply into the material while also creating a captivating product that would appeal to an authentic audience. The results of the student work from each of these assignments are discussed below.

**Research Protocol - Data Collection**

The two primary sources of data for this study were the work created by the students and field notes I recorded after each lesson in a “reflexive journal” (Lincoln and Guba, 1982, p. 248). As I was a research-practitioner conducting teacher action research in my classroom, my notes
were also participatory researcher reflections on my own actions and thus were data on myself in addition to data on the students.

Student work consisted of three collections of artifacts, one from each of the interventions. In the American Revolution Essential Question project, artifacts included each student’s GoogleDoc research notebook, their written responses to the question and the digital final projects. The final projects were created using Glogster, Prezi and Google Slides. In the Constitutional Convention Role Play, artifacts included each student’s written constitutional convention speech and each group’s Convention Resolution Presentation. Most of these presentations were created using Google Slides. The remainder of the presentations were created in Prezi, Scratch or Popplet. In the Bill of Rights unit, artifacts consist of each student’s GoogleDoc research notebook and the completed Scratch programs.

I took notes for my reflexive journal at the conclusion of each lesson. I wrote them all in one lengthy GoogleDoc, adding the date and new notes on each occasion. Another source of data was the responses to a survey administered to students at the beginning and conclusion of the interventions. My teaching colleagues graciously joined me for a Collective Assessment Conference (Seidel, 1998) to analyze some student work, providing an opportunity for triangulation of data. Although my colleagues only looked at three assignments, the questions they asked about the work helped me identify the questions I needed to be asking myself when reviewing student work. This conference greatly helped clarify what I needed to be looking for when I was looking at student work. I was able to use the teachers as a clarifying and sharpening tool on my lens as researcher.


**Qualitative Findings**

This next section shares some of the findings of this study, based on an analysis of the data. The information was organized according to themes that emerged from the data. The impact on student motivation of teaching with technology was one theme that was strongly evident throughout all units involved in this study. Many students were highly motivated by opportunities to use technology in school. However, student motivation did not guarantee fulfillment of content learning goals. In order to respond to the research sub-question, it will be demonstrated how digital technology integration was found to encourage student learning when high student motivation also resulted in deeper student engagement in course content. In the course of this study, students created multiple digital projects that demonstrated their understanding of the course material. In order to respond to research sub-questions about the impact of digital technology integration on class content and student learning, data about the process of creating these projects and the finished products were analyzed. The theme of digital project as the ‘high water mark’ of student learning emerged in this analysis. As will be described below, creating these digital projects helped many students develop a deeper conceptual understanding. As the teacher-research simultaneously teaching lessons and conducting the research, I engaged in a deep and sustained process of reflection on teaching and learning in my classroom. As a result of this reflection, my technological pedagogical content knowledge about teaching social science with technology developed. The theme of the teacher’s emergent TPACK is discussed in response to the research sub-question about how digital technology integration affects teachers’ knowledge and skills. The question of how digital technology integration affects the relationship between the teacher, the student and the content is addressed by examining the ways in which technology encourages constructivist teaching and
learning. There are vignettes that describe a few students in depth, illustrating their experience with the technology as it relates to the research questions and emergent themes.

When student motivation leads to student engagement

A theme that was persistent throughout this course of study was the impact of technology on student motivation. Technology tends to elicit strong reactions from individuals and middle school students were no different - from tech enthusiasts who wanted to be constantly plugged in to adolescent technophobes who preferred just to get their work done and move on. Whether positive or negative, the impact of technology on student motivation seemed to be drastic. Over the course of this study, I observed students who threw their hands up in frustration at the first obstacle and had great difficulty returning to the task. The opposite occurred as well - students who were highly motivated to try out the technology and thus spent much more time working on these assignments than they might have otherwise. This was evident from the students who came in to class discussing how long they spent on their homework – not as a complaint, but more as a badge of honor. They were proud that they spent so long on the task and persisted until they succeeded.

As a teacher, however, I was reluctant to rely on student motivation as the benchmark for success of technology integration. A student’s statement that ‘class was fun’ was no indication that the teacher’s learning outcomes were met, although a positive attitude toward the class was clearly more desirable than the reverse. I was wary about exploiting student enthusiasm for technology, because I did not want students to be excited just by the ‘bells and whistles’ of the course and miss the point of the learning. However, it was hard to ignore student motivation as an element in the classroom when it led to greater student investment in assignments. If an assignment hits the sweet spot of motivation, students will spend more time on the assignment
than required, go home, learn the technology and then invest multiple hours to ‘make it look cool.’ More significant than motivation is student engagement. If a student translates the enthusiasm for a project into deeper engagement with class material, then technology is appropriately challenging students and having a positive impact on their learning.

Positive attitudes towards technology integration were pervasive in responses to the student survey. When asked an open ended question about their experiences creating digital presentations, more than 70% of students included the words ‘fun’ or ‘cool.’ Reflecting on the American Revolution digital assignment, Zoey said “It was very fun … a REALLY great project overall.” While this feedback was initially gratifying for a teacher, it should be accepted at face value as evidence of deeper engagement with material.

Sometimes students were motivated about the wrong part of the project. Digital technology allows students to created engaging and imaginative projects. Many students became highly motivated to develop the multimedia details of their projects, sometimes at the expense of the depth of material and content. For example, Reuben invested significant time on the superficial esthetics of his Bill of Rights Scratch program. His program included sound effects and goofy images, telling a story that imagined Zeus as the U.S. Congress. While meant to be entertaining, the Zeus voice was actually quite grating on a user’s ear. Additionally, the program reflected a conceptual error about the meaning of the tenth amendment. Reuben presented as a highly motivated student, but the technology distracted him and his motivation was misguided. Reuben expended extra effort towards elements of the program that did not add to the quality of the program, and possibly detracted it, depending on the users tolerance for loud, distorted voices. This was at the expense of an appropriate interpretation of the amendment Reuben was studying. The program contained misinformation and was not useful as an artifact to present to
an authentic audience. If Reuben were less motivated by the creative opportunities provided by the technology, he might have maintained focus on the content requirements of the assignment and engaged more with the learning objectives. In his case, the motivation provided by technology was actually detrimental to his learning.

Like Reuben, Rachel was also motivated by the technology to invest additional time on the assignment. In contrast with Reuben, however, she stayed focused on the appropriate goals. Rachel was very intrigued by the Prezi program when she was first introduced to it in the American Revolution assignment. Prezi was an option, but in contrast with Glogster, which was explicitly taught to the students before this assignment, Prezi was simply offered as an option. Any students who wanted to use Prezi were responsible for teaching themselves how to use it. I deliberately framed this choice, with Glogster as the option for students who wanted to use a familiar program and Prezi as the option for students who wanted to learn a new program. After I told the class the options, Rachel went right to work teaching herself Prezi. Although she experienced a few challenges, she mostly progressed well. By the end of the first class, Rachel had the beginnings of her presentation and many ideas of how she wanted to continue to develop it at home that evening. The next day, however, Rachel approached me with great frustration. She said she had “spent hours trying to figure out Prezi, and it’s not doing what I want it to do.” I told her that she would have to decide if she wanted to continue learning this new program or return to the more familiar Glogster. By the end of our conversation, I assumed that she was planning to give up on Prezi and return to the easier option. I was quite surprised, however, at our next class, when Rachel showed me an almost fully completed Prezi presentation. She told me she felt she was “so close to making it work” with Prezi that, when she sat down at the computer, she opened up her project and persevered until she figured out how to make it do what
she wanted to do. She realized she had already done most of the hard work. As a result, she created a very innovative presentation. Her motivation to learn the new technology translated into a determination to produce a high quality presentation, not just in the aesthetics, but also conceptually. In her Prezi presentation, Rachel argued that differences over ideas about rights, taxes and liberty caused American Revolution, with evidence supporting each of her three points. Rachel was very receptive to feedback while working on her project. At one point out I pointed out that a slide with a full paragraph of text was hard to read. She responded by breaking down the paragraph into multiple slides, each with a unique image.

Another example of technology-inspired student motivation contributing to student learning is with the video game *Do I Have A Right?* on the iCivics website ([www.icivics.org](http://www.icivics.org)). The class started playing the game in class and, for homework, was assigned to play the game for an additional 15 minutes. Jessica was highly motivated to play games on iCivics. The teacher log on the website indicated she played the assigned game for 22 minutes. Then she came back the next day and tried out a few other games on the website. She did more than was assigned. At the time, I thought this was interesting, but did not realize it had a lasting impact. However, the learning that occurred became evident in the following assignment, when Jessica was creating her Scratch Bill of Rights project. As she began her research on the fourth amendment of the Bill of Rights, said declared enthusiastically “Oh, I totally know that court case from the iCivics game.” Jessica remembered and was able to apply the information she learned from the video game. She was excited to make that connection. This was an example of how the extra motivation that the student experienced with technology contributed to learning. There was a self-reinforcing cycle, as Jessica brought her enthusiasm from the video-game experience to the Scratch programming assignment. She was further motivated because she came to the new
assignment confident with her understanding of the material, due to her learning through the video game.

“My homework is to play video games? ... Awesome!”

A striking example of the impact of technology on student motivation occurred with the video game *For Crown or Colony*, an on-line interactive video game. The game is set in pre-Revolutionary Boston, and explores the decision-making process that colonists underwent as they decided whether to remain loyal to Britain, join the resistance organized by the Patriots and Sons of Liberty or attempt to remain neutral. Student-players assume the position of a 14-year-old apprentice, navigating the competing loyalties. The learning goals of the game are to introduce the students to the factors that led to the Revolution as well as the conceptual issues underlying the causes of the Revolution. When I introduced the game in class, many students were very excited. The biggest reaction came at the end of class, when I told the students to write, “play video game” in their homework assignment books. Eva, an avid gamer, declared loudly “My homework is to play video games? My parents won’t believe me. This is awesome!”

These students were very intrigued by the opportunity to play a video game for homework. For most of the students, this was so new and exciting that they were highly motivated and played at length, spending many more hours than had been assigned for homework. However, because this did not feel like traditional homework, some students took it less seriously. These students zoomed through the game, as they are probably apt to do when playing video games recreationally. This was problematic because these students demonstrated little recall of key details that occurred in the game. They were at a disadvantage in class discussions about the content of the game, even though they were further advanced in the game than some of the other students. For these particular students, the novelty of playing video games
for homework was a disadvantage. Tom in particular had difficulty with the accountability piece of the video-game homework. He was a diligent student who generally has no difficulty completing his homework without complaint. However, Tom was adamantly opposed to completing the worksheets that asked questions about the events that occurred in the video game. “Video games are video games. They are supposed to be fun. You can’t make us do this work!” he insisted.

In the survey, student responses to questions about the video game 'For Crown or Colony' were overwhelmingly positive. Three quarters of respondents included the word ‘fun’ in describing their experience playing 'For Crown or Colony.' This included some of the respondents who complained about technical difficulties. Despite the challenge of the program crashing on their home computers, a number of students still came away from the experience feeling that it was fun. This speaks very highly to the manner in which technology can contribute to student motivation. The students playing this game were highly motivated; they felt like it was an enjoyable way to spend their time. Many of the students completed the game very quickly. While each chapter of the game was assigned on a successive night for homework, most of the students worked ahead. Bella, a veteran gamer completed the entire game on the first night. When she discovered that there were multiple paths depending on the responses the character makes in the game, she returned to the game and attempted to complete every possible variation.

In addition to the element of fun, this history video game introduced a new approach to student work. The video game responded to the choices each player made. As a result, each student had a unique experience. The students were not used to personalized differentiation in homework. Asked to reflect on their experience, some students were troubled that they each had different experiences in the game, and thus 'missed out' on certain elements that they heard about
in class discussions. One student said it was a "little bit annoying that there were so many options in the game so you did not all do the same thing." While some students complained about this occurrence, as a teacher I think it was beneficial to student learning. Classroom conversations were much richer because students really wanted to hear from each other to discover what they missed out. Another student wrote, "When I finished it, I could go back and do it again, this time with different choices, and see how my choices had affected the ending."

Often students traded tips on how to find certain items hidden in the game. The rare students who were behind in the game, rather than be chastised by the teacher for failing to complete homework, missed out on social interactions with their peers who were further ahead. They were sure to catch up that night.

The interactive nature of the game made it very compelling to many students. One student said, "It was an entertaining and exciting way to learn more about the colonial times. It also gave you a chance to make choices about your position in life, whether you supported the colonists or not." These choices created an interactive experience that was uniquely engaging for my students, creating an experience that was not just entertaining but also valuable learning. One student, describing what it was like to play the game, said "I felt like I didn't have to memorize stuff. I just remembered stuff." With learning embedded within a meaningful experience, the knowledge was applied and relevant, at least within the context of the game. The students met Paul Revere, not as a name to memorize for a test, but as a moody silversmith and passionate member of the Sons of Liberty.

Students were asked to contrast their video game experience with learning history from a textbook. "I think I learn better because, it's one thing to learn in order to get some abstract thing like a grade, it is another to learn something to win+pass a level in a videogame," wrote one
student. Given the choice, most students preferred to play the video game rather than learn from a textbook. Another student explained "you had a ... picture and you got to interact instead of just reading something."

The role-playing video game had a significant impact on students, as the material from the game was learned and discussed in class. The survey attempted to uncover the nature of the learning that took place. In the student survey, students were equally divided between reporting they learned 'the facts' of that historic time period and the broader conceptual ideas of 'what it was like' then and how people decided which side to support. Many students shared the sentiments of the student who said they learned "What it was like back in Boston, 1770." This student continued, stating that, "I learned that it can be hard to choose sides sometimes. Trying to be neutral and answer questions that would put you in a category. I'm starting to think that it would be easier to just be complete Patriot or Loyalist." This was an indication that the video game fulfilled its goals, as this was one of the concepts the game was designed to teach. Another student indicated a similar wording, writing simply "I learned that it can be hard to choose sides sometimes."

Students were overwhelmingly positive when asked if they would recommend this video game to other teachers. One student said, "It makes you learn without realizing it. I did the game and once I was done I knew so much I didn't before from a little game."

While this game contributed positively to teaching and learning about the American Revolution in my classroom, I was reluctant to generalize from this experience to say that video games are always a positive addition to the classroom. This game worked because it focused on the specific teaching goals that I wanted to teach in my social science class, about how colonists decided whether or not to support the patriot cause. When engaged in the interactive role-playing
experience, that is, playing *For Crown or Colony*, student-players were immersed in the historic time period. This had a significant impact on student learning. My students were able to uniquely experience the sights and sounds of pre-Revolutionary Boston by playing the game. They felt that they had real conversations with British soldiers, Boston businessmen dealing with a boycott on British goods and revolutionary agitators such as Paul Revere. This was most evident in a remark in a class discussion when students were debating the loyalties of various characters in the game, as an exercise in reflecting on the choices that colonists made in the years before the revolution. When the students had to come to agreement on where to place British soldier ‘Hugh White,’ there was dissent from one student with the rest of the class about placing him at the extreme end of the spectrum, allied with the British Crown. “When I was speaking with him last night,” said Ilana, “he said that he only was a soldier because his family needed the money. He is not so bad.” Ilana’s conversation with the British soldier took place in the video game, but she related to it as an authentic experience – she had a conversation with a British soldier - and she applied what she learned from that experience. She generalized from an online virtual interaction with a fictionalized British soldier to understand the complexity of individual loyalties at that time and shared her understanding with her classmates in a class conversation.

I was very deliberate in designing student experiences when playing the video game to maximize opportunities for students to use their deep engagement with the video game to contribute to enriched learning. I introduced the game and had every student complete the first section in school, so that I could help troubleshoot any technical difficulties. I also required the students to answer specific questions for each section of the game and held them accountable for paying attention to the details of the game. A few of the students resisted the worksheets, but most of the students understood that the goal of the video game was to learn American history,
not just complete the game, and thus they were expected to retain information about what occurred in the game.

**Technology, student learning and course content**

In order to respond to research sub-questions about the impact of digital technology integration on class content and student learning, data about the process of creating these projects and the finished products were analyzed. In this analysis, the theme of digital project as the ‘high water mark’ of student learning emerged. Creating these digital projects helped many of the students develop a deeper conceptual understanding. In examining student work, the focus is generally on the final product, with little indication of the process in which the student engaged to create the assignment. When a digital assignment is the final assessment for a learning experience, there is a real question of whether or not the work accurately demonstrates student understanding. Technology can be an obstacle when the student knows more than is captured in his or her digital project. However, if used successfully, the technology fosters deeper student learning, and by engaging with the technology to create an assignment, the student produces a higher quality assignment than would have occurred otherwise. In this case, the digital product represented a ‘high water mark’ of student learning, accurately capturing the peak of student understanding. When the technology was an obstacle, it prevented students from fully expressing themselves and the finished product actually under-represented student learning. Thus, with some student work, the student knew more than was evident in their work, while in other work the process of creating the digital project resulted in deeper learning.

**Student Vignette: Jessica**

Jessica is a highly driven student. Although a happy and very friendly adolescent, Jessica is also prone to stress caused by school assignments. She tends to be a perfectionist and holds
herself to very high standards. Jessica seeks to fulfill all aspects of an assignment, occasionally focusing on the minutiae required to get a higher grade at the expense of the more significant learning goals of the assignment. While working on an assignment, Jessica will repeatedly ask the teacher for reassurance that it ‘is good,’ rather than trust her own judgment.

Jessica’s American Revolution Digital Project is an example of a student using technology to reach a ‘high water mark.’ Jessica chose the Declaration of Independence as her answer to the question of what was the turning point of the revolution. She created a Glog with an image of the declaration, as well as a few points about why the signing of the declaration was such a significant occasion. Before creating the Glog, Jessica was required to write a paper making the same argument, citing references to primary sources. Then her task was to represent her answer in a meaningful way, using a digital tool.

Jessica’s Glog was a much richer document than the essay she wrote for this assignment. Her essay was very brief and rather awkwardly structured. Her Glog, however, took advantage of the visual medium to present similar information in a much more engaging manner. The Glog was very well organized, laying out her thesis with clear structure that is inviting to a viewer. The poster was visually pleasing, but not too busy. The color scheme was 'old fashioned,' making the document appear grounded in the time of the American Revolution. There was a clip art image of an inkwell and a photograph of the actual Declaration of Independence. The text boxes were sequential, and included a significant amount of text. In contrast with many of the other students’ projects, there was more text and more information presented in the digital project than she wrote.
The Turning Point to Independence

What was the turning point for the Colonists?

The turning point for the Colonists was when the Declaration of Independence was signed.

After the Colonists signed the Declaration, they formed alliances with France and Spain, providing them with money, supplies, and troops for the new United States.

(Information from the book "Essentials of American Revolution.")

What was the Declaration of Independence?

The Declaration of Independence was a proclamation sent to the British, from the Colonists requesting freedom.

"We hold these truths to be self-evident, that all men are created equal."

This quote from the Declaration was a huge turning point for the Colonists. It basically explains that no man should rule over another man. People should only be able to rule one another with permission called "consent of the governed." It has been told that this quote written by Thomas Jefferson and the 2nd Continental Congress only meant for this rule to apply to white men who owned property. But that's not true. Jefferson and the Continental Congress really believed that all men should share the same equal rights.

(Information from ©The Bill of Rights Institute.)

The Declaration of Independence was made up of:

- **Preamble**: An introduction explaining why the Declaration was written.
- **Natural Rights**: The Colonists explain the rights of the people and the role of government power.
- **Grievances**: A list of the Colonists' complaints.
- **Resolution**: The Colonists declare independence from Britain.

Figure 5
in her essay. The text and the images were organized in an appealing manner, so that it was not visually over-stimulating, a common pitfall for students working with this medium.

Jessica was very capable when creating her project using this program. When she asked for help in class, she wanted more direction in organizing her content, not with the technical aspects of the program. In her Glog, Jessica demonstrated basic conceptual understanding. She argued that the Declaration of Independence was the turning point of the American Revolution. However, it was not clear that Jessica understood the significance of the declaration as an irreversible step by the Continental Congress toward independence. Although Jessica included accurate information, the emphasis was more on the values embodied by the declaration, that ‘all men are created equal,’ than on the severing of ties with Britain. There was a significant improvement in the depth of the response to the question from Jessica’s essay, which she completed first, to the Glog, which she completed afterwards. This indicated that Jessica returned to the research stage before proceeding with her Glog.

Jessica demonstrated great attention to detail in her Scratch computer program illustrating the 4th amendment. She worked hard on the program and paid attention to many little details, such as the color of the wallpaper in the principal’s office scene. The project demonstrated deep conceptual understanding, as the characters in the program focus on the controversy over ‘probable cause’ to search a high school student’s belongings. The opportunity to create a computer program was highly motivating to Jessica. Animated story-telling, which Scratch encourages, spoke to Jessica’s dramatic flair. In her research, she discovered a particularly relevant court case, on the topic of students’ right to privacy. There were a few moments over the course of working on this project that Jessica expressed frustration that the program was not
doing what she wanted it to do, but she quickly recovered or received help from a classmate to solve the problem.

Jessica’s research notes were detailed, accurate and complete. She transferred this information from her notes into an animated story. The story was detailed, with multiple scenes and lengthy dialogue. From a programming point of view, this required a significant amount of code. There were a few tricky elements that she was required to figure out in order to ensure the timing of each element of the program was accurate. Even more impressive, for me as her social science teacher, Jessica created a program that effectively taught a user accurate information about the 4th Amendment. The storytelling device was a sufficient hook for her to invest herself fully in creating a dynamic, engaging and information program.

Comparing Jessica’s Scratch program to her Glog, I noticed a few differences. While the Glog felt a bit stilted or awkward, the Scratch program flowed very smoothly. Jessica immersed herself in the program and created a detailed finished project that is very engaging and appealing to a user. While the Glog has all the required assignment elements, as if Jessica went through the rubric and included each element one at a time, the Scratch program was much more complex and organic. Jessica did successfully include all required elements, but she also was so engaged with the project that she was able to do so seamlessly, rather than have them stand out one at a time. Jessica was motivated by the desire to create a quality program. This was a much more challenging task than the Glog. Jessica was required to spend more hours working on it, and, perhaps more significantly, she was required to engage in meaningful problem-solving in order to get the program to do what she wanted, such as for the images to appear and disappear at the appropriate time.
The task of creating a Glog required minimal problem solving, which was very narrowly focused on the technical aspects of how to manipulate text and images in the program. These tasks were not problems to be solved but simply technical routines to master or obstacles to overcome. Jessica mastered the techniques enough to use Glogster and then focused on the content of her Glog. Computer programming requires more intellectual engagement. Jessica had to learn how a number of the functions in the programming language work, in particular the ‘Broadcast’ block, and then determine how to use the functions together to create her story. She was not learning Scratch simply in order to please the teacher. At the beginning of the project she wanted to succeed by creating a program in order to obtain a good grade. She looked at the assignment rubric, and began to work rather methodically through each requirement in order. However, as she engaged more deeply in the project, Jessica became immersed in the experience and demonstrated a more holistic approach to the assignment. Jessica wanted to succeed according to her terms, not just fulfill requirements on the teacher’s rubric. She recognized in herself a capacity to create something meaningful and was highly motivated to persevere until she succeeded. Reflecting on the experience, Jessica said, “The project took a lot of time, but I’m really proud of the work I’ve done and I hope people can learn about the 4th amendment from this Scratch project!” This suggests that the task of computer programming has the capacity to motivate students to engage more deeply in content-specific material by encouraging intrinsic motivation.
They will never know I was smoking! They don't even have permission to search my backpack! If they suggest searching, I'll just read them the 4th amendment. Good thing I paid attention in history class!
Figure 7

Student Vignette: Rebecca

Rebecca is a friendly, engaging and hard-working student. She is polite, respectful and compassionate to both teachers and her peers. Organization, planning of ideas and word retrieval are areas of challenge for Rebecca, in particular when she is required to read new information and to express her thoughts in writing. Rebecca has demonstrated remarkable determination to overcome these challenges, and thanks to her hard work and with support from a tutor, she is able to successfully keep up with the class and complete all assignments.
Rebecca’s experience with digital technology can be illuminated by examining three projects she created over a six month period - a Google Slides presentation about Crispus Attucks she created in June, another Google Slides presentation created in October for the Constitutional Convention simulation and a Scratch computer program about the second amendment, created in November. The three projects indicate how technology can help a student who typically has difficulty organizing information and demonstrating understanding to express herself.

In the American Revolution assignment, Rebecca chose Crispus Attucks as her answer to the question “Who were the people that made all the difference?” She wrote an essay and then created a presentation, fulfilling the requirements of the assignment. In the essay, Rebecca presented basic biographical information about Crispus Attucks and then argued for the significance of his contribution to the American Revolution. She writes, “Although many people haven’t heard of him, being the first casualty [at the Boston Massacre], Crispus Attucks was a very important person connected to the Declaration of Independence. Crispus Attucks was not only a martyr, and a leader, he was one of the main people that made the Declaration of Independence possible.”

The writing was rather laborious with many very broad statements. As her teacher, when I read this assignment, I worried that Rebecca had only a superficial understanding of the causes of the American Revolution and the relatively minor role that Crispus Attucks played. Rebecca called Attucks a martyr, but it was not clear that she understood how the Boston Massacre was used by the Patriots to fan the flames of rebellion. Rebecca’s paper concluded, “His name may not be remembered, but his death led to freedom which guaranteed the Declaration of
Independence.” The cause and effect relationship, a key concept of historical thinking, was not well explained in this paper.

After writing a paper to answer the question, students were required to create a multimedia presentation, using Prezi, Scratch or Glogster. Rebecca was overwhelmed by these choices and asked if she could instead make a presentation using Google Slides. Although she did not have previous experience using it, she had seen others use this program and believed that it would be easier for her to learn this program to create the required assignment. With my permission, Rebecca taught herself to use Google Slides. She learned a number of 'tricks' to make her slideshow, such as importing images, video and animations. There were 26 slides in Rebecca’s presentation. She could have fulfilled the basic requirements of the assignment with far fewer slides and applied less effort in creating the project, but once she started, she became focused and motivated to keep at it.

Rebecca’s project is an example technology supporting student learning. Google Slides gave her a way to express her thoughts that was more comfortable than a written essay. Her slides illustrated the same point as her paper - the contribution of Crispus Attucks to the American Revolution, yet her presentation had much more depth than her paper. While the paper had 211 words, the presentation slides consisted of 709 words, plus 22 images and links to 2 videos. Comparing the two documents side-by-side, it was clear that Rebecca adapted her paper to create the presentation slides, but in the process of adaptation she also pushed herself to add significantly more depth to her assignment. The contrast was evident from the opening slide. The perfunctory title of her paper “Crispus Attucks and the Declaration of Independence” was sharpened on a dramatic opening slide to “Crispus Attucks - A Declaration Hero,” with four images (see below) - two of Attucks, one of Paul Revere’s depiction of the Boston Massacre, and
one of the Declaration of Independence. Rebecca created a visual to express her thesis: Attucks’ martyrdom at the Boston Massacre led to the Declaration of Independence. This argument was elaborated in the 24 subsequent slides, in text and graphics. Rebecca used images she found on the Internet, both historic depictions, such as painting of the Boston Tea Party, and clip art, to graphically make her point, with arrows, check marks and many faces depicting happy or sad emotions. Rebecca was playful with the material, yet still able to make a serious point, rooted in the content. The bare-bones argument she made in her paper was explained in much greater detail, both with silly smiley faces indicating the colonists’ reactions to the British and also with text.

Figure 8
Rebecca’s playfulness, as well as her comfort level manipulating digital images, is evident in the image below. Rebecca labeled Attucks a ‘true Patriot’ and created an image of New England Patriots football jersey with the name Attucks and number 76, representing 1776.
Rebecca used a template to create her slides, with a blue frame at the top of each slide. She used this frame to create titles, making the slideshow very easy to follow. One slide was titled “Crispus Attucks’s [sic] part in the Boston Massacre.” On this slide, Rebecca stated “Crispus Attucks was the first casualty, the first one killed. He was a martyr, he was killed for a cause. He stood up for the Patriot's justice.” This was more detail than she included in the paper, and was organized in a more thoughtful manner.

Rebecca’s project was created with an intention on her part for the project to be viewed by an audience, on one slide even addressing the audience directly. To make explicit her argument, Rebecca stated “You probably want to know how Crispus Attucks made a big difference to starting the Declaration of Independence……” This indicated that as she was creating her slides, she was reflecting on the impact they would have on a viewer. The final slide concluded “Thank you for watching my presentation.” It was noteworthy that Rebecca made this assumption about an audience, because it was not part of the assignment that students would be sharing their projects with their classmates. Rather, the collaborative and on-line nature of the
digital medium allowed Rebecca to assume that this was a document that would be shared with an audience. It was likely that her interest in including numerous images was also motivated by a desire to be captivating for an audience.

Rebecca was part of a three-student group representing Northern Merchants in the classroom Constitutional Convention of 1787. For this unit, each student group was required to create a digital project to share their constitutional resolution with the rest of the class. By this time, Rebecca was very confident in her ability to create content using Google Slides. This was a group project, in contrast to the previous individual project, which meant that group members had to work together. While some other groups took time to come to agreement on which digital tool they would use, Rebecca very quickly convinced her partners to use Google Slides. She was confident in her ability with this program and indicated to her partners that if they used Google she could take leadership in the content creation aspect of the project. The presentation they created, “A White Merchant’s Opinion on Slavery” was noteworthy both for the simple, straightforward manner in which they present their material and for the use of images. The presentation slides were organized in a user-friendly manner, with fewer words per slide and more images.

After the title slide, the second slide contained the text of the group’s constitutional resolution about slavery. In the voice of white merchants, this group proposed that slavery should be protected in the constitution. The rest of the slides in the presentation articulated the group’s argument in support of their resolution. Each slide had brief text in the frame at the top of the page and an image or multiple images that illustrated the text. Many of the slides had multiple images in relationship with each other, such as the one below.
Slavery also helps us get cotton for the north

Figure 10

The three images, a cotton plant, an equal sign and a dollar sign, illustrated the text at the top of the page: “Slavery also helps us get cotton for the north.” This indicated the group’s understanding of the economic significance of slavery in the 19th century.

By using Google Slides, students were able to collaborate on their project, both in school and at home. Figure 11 indicates how students used the ‘Comment’ feature to reflect on their work, share feedback and move forward with the project.
When it came time to present to the class, Rebecca continued to take leadership in her group. She was the main spokesperson from her group, reading through the slides in front of the class and responding to questions from classmates. By going through the process of creating the slides, Rebecca learned the material and was able to apply it by presenting in character as a Northern merchant at the Constitutional Convention. This was particularly noteworthy, given Rebecca’s learning profile. Organizing information and creating output were not her strengths, yet on this assignment she proved herself more than capable.

The third project students worked on was a Scratch computer project illustrating the contemporary relevance of the Bill of Rights. At first Rebecca was quite resistant to using Scratch. As she struggled with the programming aspects of her project, she asked a number of times if she could ‘just make a Google Slides.’ I briefly considered making that option available to her, as I knew that she had achieved proficiency with Google, based on these two previous assignments. Additionally, I knew that I didn’t want to be asking too much of Rebecca, a student
who struggles with learning new content. I was aware that asking Rebecca to learn both the content knowledge about the Bill of Rights as well as programming skills was a lot.

However, I did not relent because I believe that these two digital tools bring out different responses from students. The storytelling element of Scratch was vastly different from the format of Google Slides. While a presentation was appropriate for sharing information in front of a live audience, my teaching goals for the Bill of Rights were different. For the project on the American Revolution, students were asked to develop a thesis and make a claim based on historic events, thus demonstrating their knowledge and analysis of the content. In contrast, my goals for the Bill of Rights unit were for students to deeply reflect on the impact of constitutional rights on contemporary life in America. Students needed to learn the text of the Bill of Rights, conduct research on landmark court cases and then apply their understanding of one of the amendments to today. I felt that Scratch would encourage students to create a dynamic storytelling project, much different than what was possible with Google Slides, which were really just colorful lecture notes.

Rebecca worked very hard on her Scratch project. She checked in with me multiple times every work period, both about the content of the program as well as the program itself. Once she figured out what to do, she went back to work and was very diligent, not getting distracted. She created a humorous program that depicts a bat asking ‘Siri’ on an iPhone about the second amendment. Thus, Rebecca’s familiarity with contemporary digital technology was embedded in the program by the use of Siri as a cultural touch point. The heart of the program was a lengthy recording of a pretend phone call between a caller and one of the plaintiffs in a landmark second amendment court case. Rebecca acted out both voices in the recording and took it all in one take. Very few students included audio in their programs and Rebecca was the only one to use it for
such lengthy or substantive information. In most of her classmates’ programs, audio was used as a humorous sound effect, not contributing to conceptual depth.

The flow of the program was relatively smooth, although also a bit stilted. Rebecca followed the program rubric point by point and this was reflected in the steps of the dialogue in the program. Rebecca is a very concrete thinker who tends to find abstract thinking challenging. The task of creating a computer program encouraged her to develop her abstract thinking, as she had to create a situation that demonstrated the significance of the second amendment in contemporary America. The program is very contemporary due to the reference to Siri, grounding the program very much culturally in America of 2013. However, Rebecca did not present a contemporary example of an application of the second amendment. Instead, the program was very literal, referring to the landmark court case by calling the plaintiff directly.

By constructing this program, Rebecca developed her thinking about the second amendment. She completed research notes and had to think what would be a captivating manner to present this information to an audience. The program also demonstrated the limits of her knowledge. Rebecca’s understanding of the details of the court case was incomplete and this was reflected in the explanation embedded in the program. Thus, Rebecca’s program did reflect a true assessment of her conceptual knowledge. By recording herself in dialogue explaining the court case, Rebecca was able to explain, to the best of her ability, how the court case led to interpretation of this amendment. By listening back to her recording and then recording until it met her expectations, Rebecca was involved in a process of revision.

Despite my positive view of Rebecca’s output, her reflection on the experience was very negative. She wrote “I did not like Scratch and I could have showed my knowledge in a different way.” Rebecca did not believe that the time she invested in problem solving her program was a
valuable experience, although I believe she was proud of her finished product. This suggests that perhaps I should have helped her reflect more on the experience, so that she could appreciate that the time she spent overcoming the frustrating stage of problem solving was worthwhile. She developed a unique and novel way to present her information, which would not have been possible with Google Slides. The playfulness and creativity she demonstrated earlier with the creation of a Crispus Attucks football jersey was evident again in the use of an iPhone and Siri to share information with a program viewer. Yet despite this playfulness, she experienced the creation process as “time consuming” and “a waste.” This is an unfortunate conclusion for a student to take away from an assignment. Perhaps if the students’ spent more time using each others’ finished programs, she would have received feedback from her peers that would have left her with a more positive overall attitude towards this learning experience.

Technology and Teacher Knowledge and Skills

As the teacher-researcher simultaneously teaching lessons and conducting the research, I engaged in a deep and sustained process of reflection on the teaching and learning in my classroom. As a result of this reflection, my technological pedagogical content knowledge about teaching social science with technology developed. Thus, the theme of the teacher’s emergent TPACK is discussed in response to the research sub-question about how digital technology integration affects teachers’ knowledge and skills. The role of the teacher changes dramatically with the introduction of digital technology into the classroom. The teacher’s exclusive claim on expertise is undermined, as students have access to information at their fingertips. The role of the teacher when teaching with technology is to design learning experiences that use technology in a useful way to support the learning objectives. The teacher applies his or her TPACK during this planning process. After designing the unit, the teacher steps back and lets the students get to
work. Then the role of the teacher is to scaffold the student learning, both in content areas and in use of the technology, so that students are in learning in the Vygotskyian Zone of Proximal Development.

Rachel created a Scratch program about the third amendment that was strong conceptually, presenting deep content knowledge, and was also sophisticated programmatically. This was particularly noteworthy because Rachel expressed great frustration during class time working on these programs, once to the point of tears. Rachel was stuck on a particular aspect – getting text to appear on the screen and then editing the text to correct an error. Rachel’s program had animated text boxes, multiple screen and background changes and characters moving across the screen and engaged in dialogue. She told a ‘tight’ story.

In reflecting on her experience with Scratch, Rachel expressed a positive overall impression, despite the problem-solving challenges involved. She stated that she “enjoyed using Scratch most of the time, but sometimes it was hard to get the program to do what I wanted.” Rachel’s description of the balance between enjoyable and challenging work involved in creating her Scratch program suggests that for this project she was consistently in Vygotsky’s Zone of Proximal Development - she felt mostly competent with the tasks and tools available to her, yet also struggled with some aspects of the task, requiring her to engage in deeper learning. Other students who indicated greater frustration with computer programming were at a less than optimal balance between challenge and competency, and thus not sufficiently scaffolded in order to maximize the work time spent in the ZPD.

The impact of the Scratch programming experience on Rachel was particularly evident in a comment she made in a later lesson. After reading an autobiographical essay written by a Polish Jewish teenager in the 1930s, the students’ assignment was to create a storyboard of one
scene in the text, imagining what the story would look like as a movie. After I explained the assignment to the class, Rachel said ‘when we are done with this, we could use Scratch to actually make the movie scene.’ Her remark came on the heels of the Bill of Rights Scratch project. This suggested that she felt empowered as a computer programmer and was thinking of ways to apply this skill as a tool in her toolbox.

Teacher Generated Menu of Choices for Students

One way in which the teacher determines the impact of technology on teaching and learning is simply the decision of what technology is available to use in the classroom. In the American Revolution digital project, students were given a choice of three different digital technologies to choose from: Prezi, Glogster and Scratch. This gave students an element of control over their learning, yet it was a carefully guided choice from a menu determined by the teacher. Students did not have the choice of avoiding digital technology entirely while creating their assignment. Before this assignment, Glogster was introduced to the students and they were given explicit direct instruction on how to use the program. Each student was required to create a Glog on the subject of his or her choice in order to ensure that everyone had obtained at least a minimum level of competency with the program. From watching them create these practice Glogs, I was able to determine which students learned the new technology quickly and who struggled to manipulate text and images in this new program. The finished products also gave me evidence that students had obtained the skills that I felt were necessary to complete the American Revolution assignment – to type in text and insert multi-media material. Providing students an element of choice can encourage them to ask for additional choices. The teacher then needs to respond to student requests for other forms of differentiation. Three examples will be discussed in this next section.
As discussed above, Rebecca was a hard working student who was not overly enthusiastic about using technology for school assignments. Remembering the multiple directions involved in learning how to use each different programs was challenging for her, and there was a real risk that asking Rebecca to keep learning new programs would come at the expense of learning the course material. In the course of this study, she asked twice to use a program that was not on the list of options for the particular assignment. In the first case, I granted her request and the second I did not. I believed that both of these decisions helped ensure that Rebecca would maximize her learning opportunity. When faced with the American Revolution project, Rebecca was very reluctant to use Prezi, Scratch or Glogster. She asked if she could make her project using Google Slides. I felt that Google Slides is similar enough to Prezi that it would not undermine the requirements of the assignment to use Google instead of Prezi. Rebecca benefited from the linear structure of Google Slides, and, as discussed earlier, created a very detailed and visually appealing presentation about Crispus Attucks. Rebecca’s second request was to make another Google Slides in place of a Scratch program about the Bill of Rights. I denied this request, as I believed that the process of creating the presentation would be substantially different than creating a computer program. In the case of the Bill of Rights project, students did not have an option – everyone was required to create a Scratch program. This was a deliberate decision, because I believed that creating the program would require a certain depth of content knowledge that is not necessarily achieved when creating presentation slides. With reluctance, Rebecca went to work on her Scratch project. Despite her trepidation, she did produce a thoughtful project. Her use of the audio recording function in Scratch allowed her to create an engaging story that would not have been possible in Google Slides. By requiring
Rebecca to use Scratch, even though it pushed her out of her comfort level, deeper thinking was achieved.

In contrast with these successful examples with Rebecca, in another case of student choice, I believe that as teacher I made the wrong choice in allowing students to create their project in a medium different than one of the assigned choices. For the Constitutional Convention resolution presentation, one group of students requested permission to create a video presentation. I had not offered video as an option for this project, because I knew the technical elements of film-making are very time consuming. In order to create a video project of sufficient quality to present to the class, these students would have had to invest many hours editing their video – much more work than their peers. When I met with this group to discuss their request, I learned that they had little experience filming and editing video, yet they were extremely motivated and claimed to want to spend the time to learn how to do so. With some reluctance, I granted this group’s request. Describing this group’s experience in my reflexive journal, I wrote, “They had fun for a few periods, and then when faced with a time crunch, they realized they didn’t know how to do it and the project ultimately failed.” The night before the assignment was due, they abandoned the film project and one of the students spent several hours creating slides for a Google Slides. Upon reflection, I believe as teacher I should not have approved their request to make a film. I let their enthusiasm overrule my judgment as a teacher and familiarity with the technology. I should have helped them identify a less time consuming project, or supported them in a different way. For example, before filming they could have written a script that had to be approved. This would ensure that they had thought about the material they wanted to present, and would have held them accountable for the material. Additionally, the group would have a written document so that, even if they did not succeed in filming and editing their
material, they would at least have the content in written form. This suggests the importance of requiring students to engage in written planning before beginning ambitious projects with technology, especially when their lack of experience means they do not even realize how demanding the project requirements may be.

**Student Vignette: Yael**

Yael is a very successful student. She excels in all subjects, demonstrating genuine interest in the content. In social science she often asks probing questions about new material and comes to class sharing examples of interesting information she learned outside class that is relevant to classroom content.

The heart of Yael’s Glog is a lengthy paragraph that outlines the student’s argument why the Patriots had the right to revolt. This paragraph is substantially different than the one submitted as the previous written assignment. Thus Yael chose to rewrite rather than use what she already had. This is an interesting contrast with Allison, the other student to include a very lengthy piece of text on her Glog. While Allison essentially cut and paste long sections from her essay, the text in Yael’s Glog is different in style and content than her essay. She essentially wrote a new essay to answer the same question. Her argument is supported with similar supporting evidence, but she added new emphasis and details. This suggests that she reviewed what she wrote for her essay and sought to make improvements. The revision process is very important for any learning, especially when students are involved in writing.

It would be worthwhile to determine what motivated Yael to engage in a deeper revision process for her writing than Allison did. In the second iteration of Yael’s writing, she refers in much more depth to the Declaration of Independence. In answering the question of whether the colonists had the right to revolt, Yael’s argument is presented in a similar structure as the text of
the actual declaration independence. This suggests that the requirement to include a primary source document in the digital project influenced Yael and her writing. She used the Declaration of Independence as her primary source, and an image of that document is featured prominently in the Glog. Yael also included images of two historic prints: Paul Revere’s depiction of the Boston Massacre and an engraving of the Sons of Liberty, dressed as ‘Indians,’ at the Boston Tea Party. The most significant aspects of each of these images are the captions Yael wrote to accompany them. The caption for the Boston Massacre calls it “a symbol of injustice in the colonies,” while the other caption reads “The Boston Tea Party - an example of the colonists revolting.” These captions suggest the potential of using a program such as Glogster to encourage students to delve deeper into the content material, while also holding them accountable for analysis.

Yael’s group used Google Slides to create their presentation for the class Constitutional Convention. She took leadership in this group project, evident from the revision history on the document. Most of the edits to the document, including all from the last day they worked on the project, were from her account. The presentation was a very smooth presentation. There was an introductory title slide, and then four slides that articulated the group’s proposal for suffrage in the constitution. The slides each included a text box and an accompanying image. The images were aligned with the content of the text, creating an inviting visual layout. The text on two of the slides was very lengthy - over 70 words each.

Yael created this presentation with ease. She had sufficient competence in using the program such that she was able to spend her work time developing the content, rather than learning the technical aspects of the program. The digital technology provided an easy way for Yael to organize her material and present it to an audience in an engaging way. For Yael, Google Slides passed the novelty stage. She took for granted that this was a way to share information.
While there was nothing particularly noteworthy in how using this digital technology had an impact on the student, it had proven to be a useful tool in the students’ toolbox. Once students such as Yael have sufficiently mastered the program, they get right to work and focus on content. This was in contrast to some of the more novel programs such as Prezi or Glogster. Students tended to get distracted by some of the fancier features of these programs, spending great amounts of time perfecting the gimmicky multimedia options, at the expense of delving deeper into content.

**Student Vignette: Allison**

Allison is a strong yet mostly quiet student. She is conscientious about getting her work completed on time, and often demonstrated deeper understanding in her written work than in her comments in class. Allison chose the Boston Tea Party as the turning point of the American Revolution. She created a Glog that consisted mostly of a text box, with large sections of the paragraph she had already written previously. The text was edited down from 412 words to just over 200. However, there was little evidence of summarization of the text. Mostly Allison cut out entire sentences to reduce the length of the text. This suggests that Allison did not engage in any deeper thinking about the material as she created her Glog. Rather, she edited her material on a very superficial level. While she was working on this project, Allison did not reflect or make decisions based on the difference between presenting information in an essay or in a Glog.

In addition to the text, her Glog contained a few multi-media items. This appeared to be the area that Allison invested her time. She included a link to a clip from a television program about the Boston Tea Party. Additionally, Allison included a quote from a primary source document, fulfilling one of the rubric requirements. This quote was the only indication that the
process of working on the Glog encouraged Allison to engage deeper with the content, because the remainder of the content was rather superficial. Her essay had no reference to this source.

I found little evidence that Allison did any additional learning or thinking about the question while she was creating her Glog, seeing as she had already written the paragraph. A more meaningful process of transforming that text into something less bulky, and more visually friendly might have forced her to reflect more carefully on the content. The technical medium lends itself well to this process, and, it now becomes clear, as a teacher I could have been more explicit with that requirement. However, it was necessary for me as a teacher to have this experience with these students to learn and be able to reflect on the material in such a manner. I now know what to do next time. Often in assessing student work, teachers tend to assume that length equals quality, and brief student assignments lack depth. While this may often be true, a carefully structured process could be developed to encourage students to first write longer essays, and then summarize their own work and identify the key points. This would then be the material that students use to create a Glog. The process of prioritizing ideas would encourage synthesis. This also touches on the ‘high water mark’ question. When students are required to create lengthy notes, the digital work they create can represent an extraction of their best ideas, not the simply peak of their learning.

Looking at Allison’s work, I wonder when technology contributes to learning. For Allison, working with technology appeared to be mostly an afterthought. The content-related work essentially all took place when she wrote her paper. Then she set to work on the Glog completing the various other components of the assignment - the tasks I made her do, such as including a quote and some multi-media elements. Allison completed the requirements as set out in the rubric, but I do not find in her work evidence of interest or personal investment in the
project. The additional elements in the Glog did not add anything to the argument from the paper about the importance of the Boston Tea Party. I do not want to assign blame to the student for failing to find this part of the assignment interesting or engaging. The assignment was not set up in a way that would motivate Allison or capture her interest. She did what was required because it was required, not because she was involved in solving a meaningful problem. I fear that although the format of the assignment looks very different from traditional school assignments, Allison experienced it in a very similar manner - she was asked to complete certain tasks by a teacher, and as a good student she did what she was required of her. The connection to the real world was not evident. Relevance was not clear to Allison, so there was no reason for her to engage or invest herself in this assignment. The technology, Glogster, is very unique. Allison did not view developing competency on Glogster as a useful skill that would help her beyond what was required to complete this particular assignment. Thus, there was no reason for her to learn any of the advanced options within the program.

For the Constitutional Convention, Allison used the online presentation program Prezi to create a presentation explaining her group’s resolution about suffrage. She created a very clear presentation, with the resolution in an opening slide in the center of the presentation, followed by four slides, each consisting of one reason to support the resolution. The supporting slides each had text as well as a relevant image to illustrate the point. Aside from a few glaring spelling mistakes, the text of the presentation was all well written. The images were all appropriate, and contributed to a viewer’s understanding of the main ideas on their respective slides. It appears from the Prezi that Allison was very comfortable manipulating text and images using this program. The slides ran very smoothly, and the focus was clearly on the content of the ideas rather than distracting multimedia, which can be a strong tendency for many students when using
Prezi. I believe that this project represents an accurate assessment of Allison’s conceptual understanding of the material. In the text of the Prezi slides, Allison articulated a thesis and supporting points in a clear and well-organized manner. Images were used in an effective effort to make the presentation more visually appealing. In this case, I believe the technology was neither an obstacle nor an aid in helping with student learning. Allison had previous experience using Prezi and was comfortable enough with Prezi that there was little she had to learn about the technical requirements of Prezi. She was able to spend almost all her time working on the project developing and organizing her ideas, rather than grappling with new technology. This was a benefit of the student’s pre-existing competency with the program. However, I believe that there was also nothing additionally stimulating about using Prezi. Perhaps Allison was motivated by a desire to create an appealing presentation for her classmates, but there was nothing specific about Prezi that encouraged or supported this desire. Creating a basic Prezi was easy enough for Allison that that was what she did. There was no evidence in the Prezi of new ideas that were generated as a result of the process of creating the Prezi.

For Allison, Prezi was a useful tool to use to create this presentation, even if it did not encourage her to go deeper with her learning. Prezi was very much a tool - a technique Allison used to create an acceptable presentation containing her constitutional convention resolution and an argument to support the resolution.

Allison created an animated story for her Scratch program about the first amendment. The story was about a student in a history class who was given an assignment to learn about an important court case. This was the device that Allison created in order to fulfill the requirement to include a reference to a landmark court case in the computer program. The program executed
very smoothly, with transitions between a number of scenes in the program, and all the texts and characters appearing and disappearing exactly when they were supposed to.

Allison was very clear about the purpose of her program: “If you watch my program I hope you will learn that according to the bill of rights, you may say things even if they are hurtful and the government is not allowed to punish you for it.” Her reflection about the process is particularly revealing. She acknowledged that she did enjoy using Scratch, although she “found the Scratch program was sometimes a bit frustrating to use because I feel that I am not a good programmer.” Significantly, however, “After I got the hang of it though I felt I could use it better than I could before.” Allison demonstrated perseverance in overcoming the frustration she experienced at the beginning of the project when she was learning how to use Scratch to do what she wanted to do. I find it noteworthy that there was no evidence of this struggle in the finished program. In her written reflection, Allison very specifically identified the technical challenge she had to overcome, stating “It can be hard when you want to change the backdrop or sprite a lot.” Despite this initial difficulty, in her program both the background and sprites changed on multiple occasions. Even thought Allison achieved competency with this programming task, she still identified it as a difficult task. Yet Allison did overcome this task so that the program ran successfully. The storytelling aspect of the story provided a suitable structure upon which to demonstrate her understanding of the first amendment. She needed to be able to change the background and sprites in order to create a storytelling animation, so she had no alternative but to develop the ability to execute this difficult task. Although it took her significant effort to learn how to do so, this extra effort did not detract from her ability to fully express her conceptual understanding of the first amendment. In contrast, there was evidence that once she was able to
use the programming language to manipulate images on the screen, she used this skill to tell her story.

In Allison’s final remark in the reflection, she states very matter-of-factly “Overall I liked using scratch for this project.” This is significant because most of what she wrote was about the struggle she had to learn the programming language and how frustrating it was to execute all her ideas. Despite this frustration, she had no hesitation calling the process of learning to program a positive experience. Becoming a computer programmer to teach about the first amendment required Allison to reflect deeply about the contemporary significance of freedom of speech. She engaged in a significant learning experience, as she learned how to demonstrate her content knowledge with a computer program. The task of telling the story she wanted to tell, in words and pictures, was a dual challenge of thinking how to articulate the story and then figuring out how to code the story in Scratch. In this manner, using technology supported teaching the social science curriculum and enriched the student’s learning experience.

**Technology and the Instructional Core**

Technology transforms the relationship between the teacher, the student and the content. When the teacher integrates technology into his or her teaching, the teacher loses his or her exclusive claim on expertise and wisdom in the classroom. Students with Internet access can uncover information that is not filtered first through a teacher or textbook editor, opening up possibilities for inquiry driven learning. This new relationship is demonstrated in Jessica’s experience creating a Glog about Sybil Luddington.

**Student Vignette: Jennifer**

Jennifer is a strong student. She is an avid reader and is very involved in online ‘fan-fiction’ communities centered on her favorite literature and television programs. She reads,
comments and creates content on these forums, and shares this interest with a number of her classmates. Jennifer is very successful academically in an unassuming manner that allows her to be part of a diverse social circle.

Jennifer created a Glog biography of Sybil Ludington, a historical figure from the American Revolution often called ‘the female Paul Revere’ for her deeds on horseback in support of the Patriot cause. Jennifer’s choice of Luddington revealed an interest in bringing more female voices into our classroom studies. Jennifer persevered in her research, despite the great challenge of locating a primary source document that referred to Luddington. This assignment provided Jennifer the opportunity to learn about Luddington, a rather minor character from the American Revolution who was overlooked in most traditional history textbooks. It is also noteworthy that I was not familiar with Luddington’s story until Jennifer brought her to my attention. Thus, the student became a source of knowledge for the teacher. When Jennifer shared her research notes with me, I realized that in order to support Jennifer’s learning I needed to conduct some research of my own about this individual. I used the sources that Jennifer collected in her research notes and pursued additional websites that I had previously identified as credible sources for information about characters from the American Revolution. As I learned more about Luddington, I shared some of my favorite sources with Jennifer, in order to help her uncover more information. However, she also continued independently on her research, persisting beyond the recommended websites I shared with students. Jennifer displayed remarkable flexibility and ingenuity in conducting this research and she did not wait for the teacher to provide her the answers.

Jennifer used multiple approaches in order to collect sufficient information to create her report. In her research, Jennifer noticed that Ludington’s first and last names were spelled
inconsistently, so she entered multiple combinations in attempts to uncover relevant documents. When Jennifer learned that the town of Ludingtonville, NY is named after Sybil Ludington, Jennifer used GoogleMaps to determine the location of the town. She then looked at the official town hall website, in search of letters or documents that would qualify as the required primary source document. When this proved fruitless, she asked, and I consented, to let a photograph of the statue of Ludington qualify as her primary source. The Glog that Jennifer created was clear, well written and had good information. This was very much aligned with the quality of the essay Jennifer wrote before creating the Glog. In this case, there was a consistent transference of the knowledge from the essay assignment to the digital creation.

The process of creating the Glog required Jennifer to think about her ideas in a new way. Recognizing the visual element of this medium, which was not relevant for her essay, she had to think of what images would capture the message she was trying to convey through her work. Thus, the photograph of the Ludington statue became a powerful artifact in her project. This visual aspect of the project allowed Jennifer to show, not just tell, the significance of the individual she was profiling. The statue depicts the teenage girl Ludington riding a horse and waving her arms, towering way above. The statue captures both the tremendous youth and the passion of this ‘hero of the revolution.’ Jennifer used the photograph of the statue as the centerpiece of her Glog. While perhaps she was influenced by the challenge she had in finding any additional images and information about Luddington, Jennifer used what she did find to create a very focused and concise Glog. The message of Ludington’s contribution to the American Revolution was conveyed in well-organized and brief sentences.

While on first reading the minimal factual information presented in this Glog appears rather superficial, the information was tightly focused on its specific message: Ludington
traveled on horseback to enlist Americans to fight back against British soldiers in Danbury, Connecticut. Before creating the Glog, Jennifer had written a very strong paper. In creating the Glog, Jennifer was required to synthesize her thinking, in order to present her ideas more succinctly. Jennifer was clearly invested in her Glog project. Watching her work on it in class, I could tell that she had fun putting it together. She was interested both in the content as well as the opportunity to present it in a visually interesting manner. Jennifer added a few visual elements to her Glog that were purely for aesthetic purposes. There were clip art images of birds and arrows and the text was contained in text boxes that were designed to look like interesting notepads. Jennifer took pride in her work and was intrigued enough with the Glogster program to take the time to add these details that were not required parts of the assignment.

Jennifer’s experience creating the Glog indicates how technology can encourage student-driven inquiry learning. Jennifer conducted in depth research online about Sybil Luddington, learning information that her teacher did not know. She synthesized her ideas in the process of creating a meaningful and visually appealing digital project. Jennifer engaged deeply with the material in an open-ended inquiry, while receiving guidance from her teacher, and created a compelling finished product.

**Summary**

The purpose of this study was to explore the ways in which teachers can positively transform teaching and learning by integrating 21st century digital technologies into their teaching. Research questions focused on the impact of technology integration on the teachers, the student and the content, as well as the relationship between these three elements. A significant finding of the study was the impact of teaching with technology on student motivation and engagement. While technology can be used as a superficial technique to spark student
motivation, teachers can make choices to teach with technology that transform student enthusiasm for technology into deeper engagement with course content. This was evident in the student learning with the video game *For Crown or Colony*. Students approached the game with glee. The role-playing nature of the game, combined with classroom debriefings of game experiences led by the teacher, allowed students to engage deeply in questions of loyalty toward the British Crown or the Patriot cause, at the eve of the American Revolution. The impact of technology integration on student learning was evident in student projects when they represent a ‘high water mark’ of student understanding. While some digital technologies were an obstacle or distraction to students, resulting in finished work that did not reflect the depth of student learning, most of the student work examined in this study revealed that the process of creating digital projects encouraged students to work more carefully and with more depth. The knowledge that the work they were sharing was published online, and thus shared with a wider audience than their teacher, encouraged students to take their work seriously.

In addition to the impact of teaching with technology on each of the three elements of the Instructional Triangle, the relationship between teacher, student and content has tremendous potential to be transformed by technology integration. As illustrated in this study, technology can be used to empower students to take ownership for their learning while also challenging the teacher’s exclusive claim as source of knowledge and wisdom in the classroom. This presents an opportunity for changing the relationship between the three elements to encourage greater constructivist learning.

Technology integration can be a fancy way for teachers to continue using traditional pedagogies, dressed up in expensive equipment and giving the appearance of representing a new form of cutting edge education. If teachers simply replace traditional pen and paper tasks with
electronic devices that maintain the same structures for teaching and learning, the great potential of technology to transform educational practices is completely undermined. However, teachers who are willing to redefine traditional hierarchical pedagogy that celebrates transmission of knowledge from teacher to student can use technology as an effective tool to implement this transformation. Contemporary digital technologies that are readily available at low to no cost can be used to shift the dynamic between teachers and students in the classroom. The Internet has reduced barriers to accessing information, requiring new ways to understand knowledge and expertise. Students can find answers to any question they can imagine at the click of a few keys, and most students are willing to accept as true the first answers that Google provides. In this context, teachers must find ways to become effective facilitators of educational experiences. As shown in this study, teaching with technology can be an effective way for teachers to do so. When learning with technology that is applied appropriately, students are empowered to take ownership of their learning. This has significance for the students’ lives far beyond the value of any particular content knowledge.
Chapter Five: Discussion of Findings and Implications for Practice

Digital technology is transforming the world in which we live at an unprecedented rate. While business, culture and society are almost unrecognizable compared to the forms they took just a decade or two ago, educational institutions have been remarkably resistant to reacting to these changes. A time traveler from a century ago who arrived in our world today might feel as if he landed on another planet, until walking into a school. The structure and form of most schools today, unfortunately, remains frozen in time, designed to meet the agrarian and industrial needs of the early twentieth century. Under these circumstances, schools cannot perform their essential role of preparing students to work and live in the world in which they will graduate. The goal of this study was to explore how teachers can teach with technology to transform teaching and learning. For this teacher action research, the researcher was also the practitioner. I used my seventh and eighth grade social science classes as my laboratory, introducing technology interventions to the curriculum. Analysis of the students’ experience of learning using technology and the teacher’s experience teaching with this technology illustrates some of the potential and the pitfalls of teaching with technology. This chapter frames the data analysis of this study within the context of previous research in the field, suggests some implications for current practice and raises questions that require further research.

Research Questions
The following research questions guided this qualitative teacher action research study:

How can teachers integrate digital technology into their teaching practice in order to transform teaching and learning?

Sub-questions:

• How can digital technology integration affect teachers’ knowledge and skills?
• How can digital technology integration affect content in the classroom?
• How can digital technology integration affect student learning?
• How can digital technology integration affect the relationship between the teacher, the student and the content?

The sub-questions are structured around the triangular ‘Instructional Core’ of learning (City, Elmore, Fiarman, & Teitel, 2009).

The purpose of this study was to explore the ways in which teachers can positively transform teaching and learning by integrating 21st century digital technologies. Research questions focused on the impact of technology integration on the teachers, the student and the content, as well as the relationship between these three elements. A significant finding of the study was the impact of teaching with technology on student motivation and engagement. While technology can be used as a superficial technique to spark student motivation, teachers can make choices to teach with technology that transform student enthusiasm for technology into deeper engagement with course content. This was evident in the student learning with the video game For Crown or Colony. Students approached the game with glee. The role-playing nature of the game, combined with classroom debriefings of game experiences led by the teacher, allowed students to engage deeply in questions of loyalty towards the British Crown or the Patriot cause, at the eve of the American Revolution. The impact of technology integration on student learning was evident in student projects when they represented a ‘high water mark’ of student understanding. While some digital technologies were an obstacle or distraction to students, resulting in finished work that did not reflect the depth of student learning, most of the student work examined in this study revealed that the process of creating digital projects encouraged students to work more carefully and with more depth. The knowledge that the work they were
sharing was published online, and thus shared with a wider audience than their teacher, encouraged students to take their work seriously. In addition to the impact of teaching with technology on each of the three elements of the Instructional Triangle, the relationship between teacher, student and content has tremendous potential to be transformed by through technology integration. As illustrated in this study, technology can be used to empower students to take ownership for their learning while also challenging the teacher’s exclusive claim as source of knowledge and wisdom in the classroom. This presents an opportunity for the changing relationship between the three elements to encourage greater constructivist learning.

**Methodology**

This study consisted of Teacher Action Research that was conducted in the teacher-researcher’s seventh and eighth grade social science classes at the Benderly Jewish Day School in a suburb of a major city in the Northeast. A variety of technology interventions were introduced to the course over a period of several months, and the impact on teaching and learning was documented. During the course of the study, students created digital projects about the American Revolution, made presentations for a class Constitutional Convention and used the computer programming language Scratch to depict their understanding of the contemporary significance of the Bill of Rights. Students learned about the causes of the outbreak of the American Revolution by playing *For Crown or Colony*, an online role-playing game. Student work was the primary source of data for this research. Additionally, over the course of the study, the teacher-researcher recorded observations after each lesson in a reflexive journal. Observations included comments by students about their experiences using technology as well as the teaching decisions made about how to teach using technology. Triangulation of data was achieved by integrating these observations with responses to student surveys about technology as
well as comments from teaching colleagues who participated in a Collaborative Assessment Conference.

**Conceptual Framework**

The conceptual framework that guided this study was built upon the concept of the ‘Instructional Core,’ suggested by City et al. (2009) to describe “the essential interaction between teacher, student and content that creates the basis of learning” (p. 22). Thus, the impact of technology integration on teaching and learning was examined in light of its impact on each of these three elements, as well as on the interaction between the three. This framework was a very helpful structure that helped determine the research questions as well as the lens upon which to assess the data that were collected. The impact of technology on the teacher was examined using Mishra and Koehler’s (2006) concept of *technological pedagogical content knowledge*, or ‘TPACK.’ A teacher applies his or her TPACK to determine how to integrate technology appropriately in order to support teaching and learning. Mishra and Koehler (2006) added another layer to Shulman’s (1986) concept of pedagogical content knowledge, or PCK, suggesting that the thoughtful integration of technology in education was a result of the interplay between the teacher’s technological, pedagogical and content knowledge, or TPACK, (Mishra & Koehler, 2006). This framework was helpful in understanding how teachers’ knowledge about digital technology impacts their ability to effectively teach with technology. TPACK was the focus for the analysis of the teacher element of the Instructional Core in this study. The development of the teacher’s TPACK was analyzed in order to understand instructional decisions made by the teacher that impacted the student-teacher-content triangle.
**Findings and Interpretations**

This study used the conceptual framework proposed by Mishra and Koehler (2006). Thus, the development of the teacher’s technological pedagogical content knowledge was a central concern over the course of this research. As teacher-researcher, I was reflecting on my students’ experience learning with technology, but more significantly I was reflecting on my experience teaching with technology. I noticed the teaching decisions I made, in order to determine how I could best use the technology to support learning. Over the course of the study, I became much more familiar with each of the programs that students used. I developed specific ideas of how each program supports or hinders student learning. My knowledge of each program was very grounded in the content-specific knowledge. For example, by watching the students play and learn from *For Crown or Colony*, I learned how this interactive role playing game helps history students learn about the factors that led colonists down the path to revolution. As a teacher, I now have a better understanding of classroom activities that will encourage students to reflect deeper on how individuals determine whether their allegiance was with the Crown or the Patriot cause. Additionally, I learned that while Prezi can help students organize their ideas, creating a Scratch computer program encourages deeper conceptual understanding.

**Impact of teaching with technology on student motivation and engagement**

Teaching with technology can have a tremendous impact on student motivation in a classroom. Students who were previously reluctant participants can suddenly demonstrate great enthusiasm to participate in classroom activities. However, the results of this study indicate that an increase in student motivation is not enough to ensure that technology is contributing to student learning. When student motivation ensures that the students are indeed engaging more deeply in course content, then technology can contribute positively to teaching and learning. However, if student excitement about technology results in distraction from specific course
learning goals, this increase in motivation is at the expense of, not a contributor to student learning. This study uncovered numerous examples of the impact of teaching with technology on student motivation, some that were beneficial and others that were extraneous or even detrimental to classroom learning.

For example, when students played the video game *For Crown or Colony*, they demonstrated high levels of motivation. The nature of the game, coupled with classroom activities that did not involve technology, ensured that students benefited greatly from this technology-infused learning experience.

On the other hand, however, while creating digital projects, some students demonstrated great motivation at the beginning of the project, but then got distracted by some of the technical or aesthetic aspects of their projects, ultimately spending less time thinking and learning about the relevant course content. This was most evident in Reuben’s Bill of Rights Scratch project. He invested considerable time and effort on the multimedia elements of the program, to animate the character of Zeus, at the expense of learning and reflecting on the significance of the 10th amendment that his program was meant to explain.

Numerous examples of student work produced in the course of this study indicated the manner in which technology can encourage students to engage deeply in course content, contributing to student learning outcomes. For example, Rachel was very invested in her project about the American Revolution. She wanted to teach herself how to use the program Prezi to create a compelling presentation. In class she voiced deep frustration when the program proved harder to use than she expected and she could not figure out how to include a video she found online. Rachel persevered, however, when she got home and returned to school the following day with a complete Prezi of which she was very proud. She added many details that were not in
the presentation the previous day, adding depth to her explanation of the ideas that underlay the conflict between Britain and the colonies.

**Digital technology to support ‘high water mark’ of learning**

The most successful examples of teaching with technology resulted in student work that captured a ‘high water mark’ of their learning. Although some students found the technology an impediment to their learning, many of the students were scaffolded by the technology in a manner that brought them to a deeper conceptual understanding. For example, the process of planning and then creating a Scratch program that taught a user about the Bill of Rights required students to reflect carefully on the contemporary significance of the right they were explaining. This is evident in the Scratch project Jessica created about the fourth amendment. Jessica’s program illustrated one of the landmark Supreme Court cases that determined the balance between students’ to privacy and their teachers’ right to search their belongings. In order to create this program, Jessica had to learn the details of the court case and then reflect on how to share this information in a clear and captivating manner for an audience. This process was educationally meaningful for Jessica, as she gained ownership over the material. While focusing on the coding details of her program, such as how to create the smoke in the student’s locker that drew the teacher’s suspicions, Jessica was integrating her programming knowledge with her conceptual knowledge. She knew from her research that this was a key detail from the court case and thus it was essential that she depict it in her program.

Many of the students’ digital presentations represented meaningful student learning. The interactive boxes that students were required to complete in order to create a Prezi acted liked a digital graphic organizer, helping students organize their thoughts and ideas.
**Teaching with technology to encourage constructivist pedagogy**

According to Papert (1980), people learn best when provided with opportunities to design, create and build meaningful projects. Constructionist learning environments provide opportunities for modeling useful real life learning habits by their emphasis on learning by designing, creating, programming and sharing with the community (Bers, 2008). The data from this research study indicate how teaching with technology impacts the relationship between students, the teacher and the content in a manner that encourages constructivist learning. Students were engaged in making meaningful projects as they designed, created and programmed and then shared their assignments.

**Development of teacher’s TPACK**

While simultaneously teaching these classes and conducting this research, my technological pedagogical content knowledge developed. By documenting and reflecting on each learning experience, I was watching closely to see how technology was impacting the teaching and learning in my classroom. This is an attitude that all teachers need to adopt, as a form of ongoing learning. There is not a fixed body of knowledge that a teacher can learn by rote and then expect to be able to act upon. Rather, technology, pedagogy and content knowledge are engaged in an interactive relationship. The rapid rate of change in the field of technology can be assumed to be constant. Thus, a teacher’s TPACK is necessarily always a work-in-progress.

A vital step for teachers in learning how to teach with technology is creating a sample project for any assignment that students are going to be asked to complete. Creating the model is a way that the teacher can develop his or her TPACK. The teacher needs a sample to show students what to do, but the teacher also needs the experience of trying to answer the questions, find the images or whatever the task is, in order to reflect on how the technology impacts the learning. Before I had my students create their Glogs, I created one myself. This process was
very valuable for me, as I taught myself how to add text and images, and how to organize items on the page. I noticed that the nature of the program makes it very easy and therefore tempting to include numerous multimedia on one page, yet the resulting finished product can be quite distracting to a user. Thus, as the teacher I was able to anticipate this potential pitfall, and guide students about how to determine an appropriate number of multimedia to include on one page. Creating a sample will still not guarantee that all obstacles are anticipated and avoided, but it often brings to light many of the most obvious ones. Digital technologies are often so open ended that students will use them to create content in ways unimagined by the teacher. But many students struggle with the basics, especially when trying a new program. Unless the teacher has had similar experience encountering this difficulty and then figured out how to overcome it, the difficulty can slow down the student significantly when he or she meets this challenge. The teacher needs to model and share his or her experience creating a project, both what worked and what didn’t work.

I ensured that students engaged in peer review of each other’s Glogs, with a specific focus on how well the Glog presents the relevant information. This helped a number of students remove extra items they included in their projects that did not add depth. I was able to plan and implement this learning activity to scaffold my students’ learning only because of my experience designing a Glog myself.

One of the most valuable ways in which the teacher’s TPACK develops is just by watching and listening to the students. As my students struggled with expressing their understanding of the Bill of Rights in a Scratch program, I learned which parts of computer programming can be obstacles to students, and what can encourage their learning. I realized students needed to be comfortable with the Scratch programming concept ‘Broadcast’ in order to
efficiently create compelling programs. While a couple of the students inferred this concept on their own, many of the students were either stuck or created much more complicated and inefficient story-telling programs. Once I recognized that this was occurring, I integrated this knowledge into my TPACK and acted on this knowledge by giving those students a mini-lesson on how to use the broadcast command in Scratch.

**Recommendations**

The findings of this study will contribute to academic research on teaching with technology, while also offering some guidance to practitioners who are already engaged in the challenging work of transforming teaching and learning by teaching with technology. As discussed in the Literature Review, there is tremendous enthusiasm in the popular press about the potential for digital technology to transform teaching and learning, but there is very little research about the impact of this technology, and whether or not it lives up to its promise. This study has demonstrated some ways in which students engage in deeper learning by creating assignments using digital technology. Digital technology can help students reach a deeper level of understanding, and thus their finished work demonstrates a ‘high water mark’ of student learning. However, teachers cannot simply assume that by assigning a digital project their students will produce higher quality work or develop stronger conceptual understanding. Teachers must apply their own emerging TPACK in order to make decisions about how to integrate technology in their teaching and in order to align pedagogy and content-specific learning goals with appropriate technology. The temptation for a teacher to teach with technology in order to encourage student motivation in class can be great. However, teachers must be careful in their decisions to integrate technology, to ensure that student motivation can be translated into deeper engagement with course content. The findings from this study suggest
that while student motivation is a necessary starting point for effective teaching, student enthusiasm for using technology in the classroom must not be mistaken as evidence of student learning. When teaching with technology, teachers must seek to channel high student motivation so that it will lead to deeper engagement with course material. This can be achieved by applying a TPACK that represents integrated knowledge of the content specific learning goals, effective pedagogy to actualize these goals and appropriate technology support this pedagogy.

**Significance for teachers**

This research study has significance for teachers who are looking to teach with technology. The most significant finding for teachers is that when teaching with technology, the teaching and the teacher still matter. At no point in this study did technology appear to eliminate the need for a teacher. None of the digital technologies in this study were able to make any of the numerous teaching decisions that are part of every lesson. Teaching is still teaching, even when adding the qualification of teaching *with technology*. Given this understanding, however, the significance of the teacher’s TPACK becomes even clearer. Teachers are only able to effectively make all the important teaching decisions if they are able to do so by applying a developed TPACK.

While the findings of this study indicate how important teachers remain for technology integration in education, the role of the teacher when teaching with technology changes from sole expert in the classroom to facilitator of student learning experiences. This has implications for teacher preparation. Teachers must become comfortable letting their students know that they are all learners – that teachers do not know everything. Making this vulnerability explicit to students can be especially challenging for veteran teachers who have taught for years in the previous hierarchical paradigm, and that they were students in as well. Yet if teachers are not
prepared to embrace the role of learning guide for their students, they are not using technology to empower students but rather simply to reinforce previous teaching methods, albeit with more expensive equipment.

**Implications for social science teachers**

There is a small yet growing body of research into the potential for teaching with technology in social science. In particular, the opportunity to use technology to support inquiry-based learning is significant. The findings of this study support these previous studies. When given the opportunity, history students take advantage of the constructivist learning that digital technology can allow. Jennifer’s experience researching Sybil Luddington is an example of the approach advocated by Doolittle and Hicks (2003), using technology as a ‘tool for inquiry’ to introduce a more constructivist approach to learning. Social science teachers need to become comfortable no longer being the sole source of wisdom and knowledge in the classroom. Students with Internet access can learn in-depth about specific events or people, well beyond any generalized knowledge of the teacher. Effective social science teachers must understand that this is an opportunity, not a threat. Rather than limiting access to maintain the teacher’s sole claim as content expert, the teacher needs to celebrate the decentralization of expertise, while also teaching the important skills of accessing the credibility of sources.

According to Hernández-Ramos and De La Paz (2009), digital technologies “are uniquely capable of supporting rich, complex, and nonlinear representations of knowledge and understanding” (p. 153). This resonates with the findings of the current research study. Student digital projects demonstrated ‘rich, complex’ understandings using Prezi, Scratch, Google Slides and Glogster. These were the projects that reflected the ‘high water mark’ of student learning. Students used the technology to capture the learning that emerged while working on the projects.
Heafner and Friedman argue that the collaborative tools of the Internet should be used to allow students to become “actively engaged in the subject matter in order to develop their own understandings, and thus become generators of knowledge as well as active contributors to the Internet” (Heafner and Friedman, 2008, p. 300). This is the process in which my students engaged when creating their digital projects. The Bill of Rights Scratch projects were created online and students knew they were creating them for a global audience. Thus, the students were generators of knowledge, as Heafner and Friedman recommend.

*Any Middle School classroom*

While this study has been focused specifically on a middle school social science class, there is much that can be applied more broadly to teaching and learning. The significance of the teacher’s TPACK is true for all teachers, regardless of the age of the students or the content taught. All teachers must learn to reflect on their experiences in order to generate personal knowledge about how to teach with technology. Another finding that is relevant to all teachers is the complicated impact of teaching with technology on student motivation. Teachers should be very cautious about exploiting technology to generate student motivation for a course. Like giving students ice cream and candy, student excitement is not guaranteed to translate into greater attention on class learning outcomes. The teacher needs to be constantly aware of the goals and how technology can be used to fulfill those goals. Effective technology integration should strive to move from student motivation to deeper engagement with course content. Teachers of all subjects should have a careful eye tuned on students when they are creating with digital tools, scaffolding the learning process to ensure that the finished project will result in an assignment that reflects a ‘high water mark’ of learning.
Implications for school leaders
The findings of this research study offer valuable guidance to school leaders who are making decisions about allocating school resources in order to support technology integration. While technology was been seen to contribute to positive student learning outcomes, the use of technology does not guarantee this result. There is a tremendous range in what can occur when a teacher teaches with technology. Although the teacher might appear to have a less significant role, because he or she is spending less time at the front of the classroom as the center of attention, this study has revealed that the decisions the teacher makes about what technology to use, and how to support students when they are using the technology, are hugely significant. Thus, school leaders who want to support technology integration would be advised to invest in professional development that encourages teachers to develop their TPACK.

Significance for Jewish day schools
The findings of this research study have particular significance for Jewish day schools. As a field, Jewish day schools are struggling to effectively integrate technology. The significance of the transformation of technology on society has been recognized in Jewish education (Woocher, 2008) yet schools continue to struggle to determine how to effectively teach with technology. By virtue of their independence, Jewish day schools have tremendous autonomy to determine what they teach and how they teach it. This is an opportunity that could encourage great innovation, yet it also could undermine effective partnership and knowledge of positive trends in the wider educational world. For too long, too many Jewish day schools have been attempting in isolation to develop their responses to a changing world. This study, by documenting the impact on teaching and learning of a number of technology interventions in a social science class in a Jewish day school, offers examples that other day schools can adapt.
It is important to encourage teacher leadership so that teachers in day schools can experiment with technology integration, while also encouraging collaboration. Teachers no longer need to solve all their teaching problems of practice by themselves in isolation.

**Researcher Reflections**

In conducting this research study, my knowledge and skills about teaching with technology developed. I now have a better understanding of how Popplet can be used to help students organize their thoughts in the midst of a learning process, while Scratch programming encourages students to develop a deeper conceptual understanding. In light of several lessons that were undermined by technical glitches and website crashes, I learned how vital it is to ensure that the technical infrastructure can support the lesson plan.

In order to take full advantage of my new learnings, as teacher I need to integrate my new knowledge about the technology with my pedagogical content knowledge. I learned by studying my students that Prezi templates can help struggling students organize their thoughts in a logical manner. I also learned how some technology could be an obstacle that undermines student learning. When a student struggled to learn how to import an image into her Glog, she spent valuable time on a technical challenge, rather than engaged in meaningful learning. As her teacher, I need to be able to anticipate these pitfalls and support students in order to keep them focused on the appropriate learning tasks.

As both researcher and classroom teacher, over the course of this study I learned how some technology supports deeper student learning. In these cases, students were motivated, intrigued or just engaged by the technology in a manner that encouraged them to think more, different and deeper. It is now up to me to ensure that when I teach with technology, I can repeat these successes and avoid using technology in ways that distract or divert students from the
course learning goals. The appeal of multi-media content is very strong. Many students, when they are creating online content, gravitate toward these more engaging items. As veteran web-surfers, they want their school projects to be as engaging, stimulating and funny as the online content they consumer. This aspiration, however, does not always align with the desired learning outcomes of the project. As teacher, I believe I have to be very explicit with my students about the goals of each assignment and remind them at every stage of the process. Written rubrics and checklists of project requirements can be used to help keep students on task. Breaking down projects into smaller steps can also ensure that students are staying focused as they create. Students can do significant pre-planning of their project on paper, before starting a digital project. Requiring the student to get teacher approval of their planning notes is a way to ensure the student has collected enough content and has also done some thinking of what they want to create, before they sit in front of the screen. Letting the students know that their projects will have an authentic audience might be another way to help students stay focus on the specifics of their task. For example, if each student has a different area of content that they are responsible for teaching to their classmates in preparation for a test, they will know their audience is counting on them to include the content and not just entertaining multimedia.

A strong message that I take away from my experience as both teacher and researcher in this study is the continuing importance of the teacher when teaching with technology. At no point in this study did the technology replace the teacher. In contrast, the technology required the teacher to be constantly involved and reflecting on the alignment of teaching goals and methods. The impact of technology on the students was dramatic – as teacher I needed to ensure that their enthusiasm for the technology did not distract from but rather enhanced the educational goals.
Teacher needs to remain very involved in every step of the learning process, as a guide to help students remain on track.

After concluding this study, I am much more reluctant to rush to integrate new digital technology into my classroom teaching. While I learned many tricks and techniques to ensure smooth implementation of projects using technology, I was also struck by how easy it is for students (and their teachers) to become distracted by the technology and lose focus on the learning goals. The high impact that technology can have on student learning is very attractive to teachers who want their students to enjoy class, yet there is also a great risk that the motivation does not lead to greater engagement. As a teacher, I now want to be much more deliberate with all decisions I make to teach with technology. I have expanded my repertoire of effective teaching methods that use technology and I have developed a more nuanced TPACK that I plan to apply at every opportunity when I decide if and how to use technology in my teaching. I struggle to maintain skepticism rather than cynicism when faced with the overwhelming quantity of commercial products that claim to provide effective ways for teachers to integrate technology. My research findings have made me an advocate amongst my teaching colleagues, my school administration and the Jewish day school field, for teacher professional development that helps teachers develop their TPACK. It is clear to me that without such an emphasis, scarce resources are allocated towards products that undermine the true potential of technology in education.

One example of the impact that this study had on my attitude about technology in the classroom is reflected in the vocabulary I choose to describe it. When I began this study, I used the term ‘technology integration’ to describe classroom activities that involve digital technology usage, by either teachers or students. As I reflected on the experience of the students and myself as teacher over the course of this study, I realized that ‘technology integration’ is an
inappropriate term because it emphasizes the technology, shifting focus away from teaching and learning. In response, I now believe a much more appropriate way to describe the process that interests me is ‘teaching with technology.’ These words make clear that the most important part – the verb, representing the action that takes place – is the teaching, not the integration. Using the term ‘technology integration’, I fear, creates an assumption that the goal is to introduce more technology to the classroom. In this framework, more technology is ‘better.’ My research indicates that this is not accurate or appropriate. By using the term ‘teaching with technology,’ it remains clear that technology is the tool that can be used to impact teaching. The impact of technology on teaching is something to be analyzed critically and qualitatively, but always the focus is on teaching and learning. A teacher teaches with technology when it will contribute to the learning goals. Some technologies will support this, while others will undermine classroom educational goals.

**Suggestions for Further Research**

The findings from this study suggest many areas that would be fertile areas for future study. The impact of technology on the specific content was only briefly explored. One question that could be explored more deeply is how students can use technology when conducting research. The Internet gives students access to almost unlimited information. This includes a wealth of archival documents giving students unprecedented access to primary sources. On the other hand, the open access nature of the Internet exposes students conducting online research to commercial and poor quality historical writings. Thus, an important question is how to effectively teach students to assess the quality of sources they uncover online. Another area of interest would be the long-term implications of teaching with technology. Research could follow up on the participants in the current study to determine how the process of creating digital
projects impacts their retention of course material. The long-term impact on student behavior in other classes could be a rich area to explore. Do students bring their experience with technology from one class to other classes? Do students stay motivated when the novelty of technology wears off?

Parents and their relationships with their technology-infused children were beyond the scope of this study. Yet parents of middle school students have a significant impact on their children. Many parents are very wary about impact of technology on students. Future research could examine the impact of teaching with technology on parent attitudes toward their child’s use of technology, with the aim of determining how to best develop partnerships between teachers and parents to support student learning.

While there is already a significant and rapidly growing body of research about TPACK, the importance of teacher TPACK as revealed in this study indicates it continues to be a worthwhile area for future research. Areas for future research could be how teacher preparation can support development of TPACK and how schools can implement professional development to support veteran teachers’ in developing their TPACK.

This study focused on the specific experience of one teacher in one classroom. Yet for systemic change to occur, teachers throughout the school must be teaching with technology. An area for future research is how teachers can collaborate with colleagues to support school-wide transformation through technology integration.

**Summary and Conclusion**

After analyzing the findings of this study, I would like to suggest the following framework for teachers to use when teaching with technology. The goal of the framework is to help teachers respond to Skiba’s (2010) challenge “that teachers must be able to answer every
time they integrate technology into their teaching: ‘Am I being digitally wise in my decision to facilitate the student’s learning by using this particular technology?’” (p. 252). In order to be ‘digitally wise,’ teachers must be able to apply their TPACK. TPACK consists of the integration of three otherwise distinct bodies of knowledge: technology, content and pedagogy. In the sphere of technology knowledge, the teacher must have some understanding of the direction in which the particular technology will push the teaching and learning. Thus, in order to make an informed teaching decision about how to teach with any specific technology, teacher must know what the technology can do. Related questions include issues such as whether the digital tool is intended as a commercial or educational product. The teacher must be aware if students will be exposed to ads, inappropriate, distracting or irrelevant content when using a particular technology.

In order to make appropriate and informed teaching decisions about technology integration, teachers must also have sufficient knowledge about their students’ experience and abilities with technology. The teacher should know if the students know how to safely navigate the web and how sophisticated they are at conducting research online. The students are one important part of the teaching context that must be taken into consideration for effective technology integration. The teacher must be able to anticipate the likely parental response to teaching with technology, to ensue that parents will be helpful partners and not undermine the initiative.

As part of the TPACK, teachers must have developed pedagogical knowledge about the course material and specific assignment goals. The teacher needs to be able to articulate the skills students need to be able to complete the task. This includes skills specific to the particular program being used, such as how to use the ‘broadcast’ block in Scratch or how to import an image to a Google Doc, as well as non-digital skills such as note-taking, following deadlines,
reading and following assignment directions, appealing to an audience and visual organization.

Consistency between goals and tools is a key to success for teaching with technology.
References


Ben-David Kolikant, Y. (2009). Digital Students in a Book-Oriented School: Students’ Perceptions of School and the Usability of Digital Technology in Schools. Educational
Technology & Society, 12 (2), 131–143.


and sustain teaching. *The Teachers College Record*, 103(6), 1013-1055.


Appendix A - Student Survey Responses

How comfortable are you with digital technology?

<table>
<thead>
<tr>
<th>1 - extremely uncomfortable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 - extremely comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

How confident are you with using digital technologies to solve a problem or find answers to questions that matter to you?

<table>
<thead>
<tr>
<th>1 - extremely uncomfortable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 - extremely comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

For each of the following digital technologies, please indicate your level of experience:

<table>
<thead>
<tr>
<th></th>
<th>Beginner</th>
<th>Novice</th>
<th>Capable</th>
<th>Very experienced</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video games</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Watching videos online (YouTube)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Reading news/entertainment</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Listening to music</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>GoogleDocs</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Digital photography</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Computer programming</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>YouTube/uploading videos</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Recording/sharing music</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Skype/Facetime</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Text (SMS) messaging</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Facebook</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Twitter</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Instant Message</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Recording/Sharing music</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
For each of the following types of assignments, please indicate how likely you would be to use digital technology to help you complete the assignment, if given the opportunity:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>1 - Very unlikely</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 – Very likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studying for a test</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Writing an essay</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Conducting research</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Learning new information</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

In what ways do you enjoy using digital technology to learn/create something for fun?

- I enjoy creating new art pictures online.
- I like making funny scratch projects and writing stories digitally.
- How to do stuff
- Many
- I enjoy making fun quizzes that other people can take or taking quizzes that others have made.
- Research
- I like to learn about the WNBA so I search things on google
- I like power point and photo editing apps
- I like using art programs
- I don't know it's just fun...
- Writing essays research presentations

In what ways do you enjoy using digital technology to learn/create something for school?

- Writing essays is easier online, and studying for quizzes and tests is more fun and simpler.
- I like using Goolge Docs, Quizlet, and for research.
- There is a lot of information and so many different ways and options to do things.
- Not Many
- Glogster
- Research
- I enjoy doing research online.
- Searching things and you don't have to be very a good artist just have an artistic mind.
- I use Google to find information that I need
- Writing essays
- Research presentations
- Type papers
### Attitudes towards Technology and Learning:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Slightly disagree</th>
<th>Indifferent</th>
<th>Slightly agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is important to use digital technology for learning.</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>I am more aware of the potential of the internet for learning than most of my teachers.</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>When a topic interests me, I would rather learn about it from the Internet than from books.</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix B – Technology Tools

*For Crown or Colony* - an on-line interactive video game set in 1770 Boston. Game players assume the role of a 14-year-old printer’s apprentice in pre-Revolutionary New England and must navigate the competing loyalties that colonists underwent as they decided whether to remain loyal to Britain, join the Patriot resistance or attempt to remain neutral. For Crown or Colony is published by Mission US.  [www.mission-us.org](http://www.mission-us.org)

iCivics is “a non-profit organization dedicated to reinvigorating civic learning through interactive and engaging learning resources.” [www.icivics.org](http://www.icivics.org)

Glogster is a website that allows users to create graphic blogs or ‘glogs’ that can include text, images, photos, audio and videos. [http://www.glogster.com](http://www.glogster.com)

Prezi is an online tool that allows users to create dynamic presentations. [www.prezi.com](http://www.prezi.com)

Popplet is an online tool that allows users to create graphic organizers. [www.popplet.com](http://www.popplet.com)

Scratch is an educational computer programming language designed by Mitch Resnick and the Lifelong Kindergarten group at the MIT Media Lab. [www.scratch.mit.edu](http://www.scratch.mit.edu)