Voices of middle and high school teachers on the knowledge, skills, and motivation needed when using iPads in teaching

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Dissertation

VOICES OF MIDDLE AND HIGH SCHOOL TEACHERS
ON THE KNOWLEDGE, SKILLS, AND MOTIVATION NEEDED
WHEN USING iPADS IN TEACHING

by

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JEUNGAH KIM
Boston University School of Education, 2014
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ABSTRACT
This study reports teacher self-perceived needs for using iPad mobile technology (MT) in terms of knowledge, skills, and motivation. Using qualitative methods, twelve experienced teachers who had already used iPads in their teaching for at least one year were the participants in interviews, classroom observations, and document analysis. The teachers’ observations and reflections on using MT in education can contribute to an understanding of how education may improve through the use of MT.

The overarching research question was: which factors, related to knowledge, skills, and motivation, do teachers report as influential when using MT, specifically iPads, for educational purposes? The questions that guided this study were:

- What components of knowledge do teachers think they need to use iPads?
- What skills do teachers think they need to use iPads?
- What motivates teachers to integrate iPads in the classroom?

The data suggested that the participating teachers relied on sixteen elements of skills, knowledge, and motivation when integrating iPads in teaching. However, when the teachers reported the application of those elements in the iPad integration process, they
tended to focus on instructional goals, strategy and implementation, which revealed the intertwined nature of those sixteen elements that teachers rely on. Based on these teachers’ intertwined application of skills, knowledge, and motivation toward instructional goals, this study proposed a refinement of the TPACK conceptual model as a three-dimensional “web” diagram, to include these practical elements. The diagram also includes motivation. The history of educational media and technology has repeatedly found that motivation is an important factor in the technology integration process.

Conclusions include that adding motivation to the model to expand the TPACK framework (Mishra & Koehler, 2006) is important and that the holistic view of TPACK and motivation allows educational stakeholders to gain a better understanding of teacher needs for MT integration. Findings also include suggestions for better strategies and policies regarding MT training to take advantage of the uniqueness of the iPad and other MT that may improve and enhance teaching and learning.
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CHAPTER 1

1. INTRODUCTION

Chapter one presents contains an overview of this study, including personal motivation, research questions, rationale, and research methods. The chapter begins by explaining my personal experiences that motivated this dissertation.

1.1 Informed by Experience

The ideas for this dissertation were derived from my experiences working as an educational technologist. The following two experiences motivated me to conduct the research: (1) an experience demonstrating the importance of understanding teachers’ motivation when incorporating technology; and (2) a positive and negative experience demonstrating the importance of teachers’ skills and knowledge to integrate technology into their teaching.

In Fall 2012, when I was a doctoral candidate and part-time educational technologist, Boston University (BU) decided to upgrade their Blackboard LMS from Blackboard 8 (BB 8) to Blackboard 9 (BB 9, also called “Blackboard Learn”). To help the School of Education (SED) instructors migrate their courses from BB 8 to BB 9, I was hired by the head of the SED IT center to provide two BB workshops, one in December 2012 and another one in January 2013. I was also to provide five office hours every Tuesday during Spring 2013 for individual consultations in the use of BB Learn. The two workshops were designed to cover questions, such as how to migrate their courses from BB 8 to BB 9, when to complete this process, and what happens to courses
not migrated by the deadline. This workshop additionally covered the new interface and features of BB9 during the workshops to help instructors become familiar with it and to help them organize their course materials. To provide hands-on experience, the workshops were held in a Mac-computer lab in SED. Instructors could also request a PC computer if they preferred to use a PC.

For office hours, instructors could come and meet me at the SED IT center between 10am – 3pm every Tuesday to ask any questions they had regarding BB 9. Unfortunately, the attendance rate was low for both the workshops and office hours. Only five out of 70 professors attended the workshops. Only two SED faculty members visited the office hours, for a total of one hour, during the semester. When reflecting on this experience, I asked myself many questions. Why was the attendance rate so low? Was it because of the quality of the workshops? If the instructors did not come at all, how would they know the quality of the workshops? I initially perceived the failure to be my own, a failure to deliver effective workshops. With these questions in mind, I met with Dr. Domenic Screnci, the Executive Director of Educational Technology, Training and Outreach Information Services and Technology at Boston University. In particular, we discussed the importance of faculty motivation to seek out training in the use of technology and the proliferation of mobile technology (MT) for education. As a result, I was inspired to question key factors that motivate both the use of mobile technology in the classroom and the degree to which instructors seek out or participate in training to develop their knowledge using MT. To help educational technologists design future workshops, one of the aims of this study would be to determine factors that help teachers
to use mobile technology for school-related work. This dissertation is the account of that work.

The second experience arose as a result of my volunteering at an educational non-governmental organization (NGO) that brings mobile devices to the developing world to improve the quality of children’s education. In Spring 2013, I was asked to go to Tanzania to provide workshops for teachers in the use of mobile technology, specifically Android phones and educational apps. I found this assignment very difficult, as I neither understood what aspects of mobile technology to address nor the teachers’ skill levels. As a result, these workshops were not appropriately tailored to their needs.

We only had three days of workshops, which was not enough time for me to improve the teachers’ technological skills and pedagogical knowledge to incorporate MT into their teaching practices. Furthermore, the training materials and content focused only on technological knowledge. My workshops covered how teachers should prepare the hardware to operate educational software—(1) how to operate a specific app, (2) how to use File Manager to organize applications, and (3) learning the differences between installing Android Application Packages (apks) on an Secure Digital (SD) Card and installing them in phone memory. Because I assumed the teachers would be aware of pedagogical benefits of mobile technology and the workshops would focus only on the technology itself, I did not address how MT can benefit teaching and learning. Lastly, the workshop handouts only describe how teachers can use equipment, but did not explain any teaching resources, such as examples of learning activities or lesson plans.

Within two weeks following the workshops, the ineffectiveness of the workshops
revealed that the focus was inappropriate. Due to the gap between teacher needs and the workshop content and resources, teachers neither understood the purpose of the workshops, nor were they interested in participating in the workshops. They had no clear ideas on how to integrate mobile technology to benefit students’ learning and had no competence integrating MT in the classroom. After I returned to Boston, teachers reported that they could not use MT for teaching.

The failure of workshop experiences provided a chance for me to reflect upon the history of educational technology. Research suggests that professional development workshops should serve the needs of teachers within a relevant context, with a useful pedagogical approach and with relevant examples (Cuban, 1986; Saettler, 1990), because “[s]imply providing off the shelf workshops designed by external sources will not have as great an impact as when teachers are surveyed and workshops are tailored to their needs” (Baylor & Ritchie, 2002, p. 410). Workshops that are tailored to teachers’ needs will be able to help teachers “to do a better job of what they already decided had to be done and matched their view of daily classroom realities” (Cuban, 1986, p. 66). Cuban’s research found that when technology meets the self-described pedagogical needs of teachers, they would be willing to alter their teaching practices to adopt new technology. However, he also found that when technology is introduced by mandate or simply by how to use it, they were often reluctant to adopt it (Cuban, 1986; 2001). Had I known their needs, I could have consequently provided more useful workshops that stimulated their interest in incorporating mobile technology (MT) into the curriculum and increased their skills and knowledge.
My experience, as a volunteer educational technologist, has reiterated a fundamental issue in the introduction of educational technology throughout its history. Teacher-reported needs, in terms of skills and knowledge, must be investigated prior to designing professional development for them. The next section introduces the features of MT as well as the uses they present to their utilization in education.

1.2 The Problem of Mobile Technology

1.2.1 Background of the problem

Mobile technology (MT), such as Smartphones and tablets, combines both communication and computing features. People carry these portable devices anywhere to make calls and send text messages or emails to interact with families, colleagues, and friends. They can also use diverse mobile applications (apps), like calendars and schedulers in order to keep track of their daily events and work tasks. Using cloud-based file-sharing apps like Dropbox, people can share, save and work on files at their convenience. Mobile communication, collaboration, and information accessibility enable people to work in different locations and may give them greater flexibility in their use of time. Along with these increased functionalities, the cost of mobile technology has decreased, enhancing the ownership and accessibility of MT among students. According to Pew Research Center (2013b), 78% of teens in U.S. have a cell phone (p.6). 74 % of students ages 12 – 17 use mobile devices as a tool to access the Internet rather than using other devices such as a desktop or laptop computer (p.4).

Both increased accessibility and functionality of MT is changing the way people work, find information, and communicate, which is influencing the educational
environment (Jacobs, 2011). Educational leaders and technologists see the potential of using MT to support teaching and learning and argue that MT is one of the new teaching tools to educate our next generation (Erickson, 2012a; Erickson, 2012b). In the Horizon Report 2009, an annual report that updates a long term research project studying emerging technology for education, researchers suggest that mobile technology is a flexible teaching solution that can support learning in a variety of ways by offering diverse new technology features such as multimedia communication channels and a touch screen with educational applications (Horizon Report, 2009, p. 6).

Researchers have examined the use of MT in the classroom by early adopters and reported its educational potential as well as challenges to its use (Attewell, 2005; Herrington, Herrington, Olney, & Ferry, 2009; Kim, Mims, & Holmes, 2006; Kukulska, 2010; Mifsud, 2002; Naismith, Lonsdale, Vavoula, & Sharples, 2004; Pattern, Sanchez, & Tangney, 2006; Prensky, 2004; Seppälä & Alamäki, 2003; Shuler, 2009). This research suggests that using mobile technology has been utilized to: (1) improve access to learning materials, (2) stimulate collaborative learning activities, (3) promote personalized learning experiences by providing a tailored lesson for each student, and (4) provide a constructivist learning environment, allowing students to develop their own learning resources through multimedia features (For detailed discussion, see 2.3.4.1 below).

Along with these potential benefits, research has also reported a number of trade-offs and challenges in relation to the use of MT: accessing inappropriate information (Goad, 2012; UNESCO, 2011), classroom distraction (Campbell, 2006; End, Worthman,
Mathews, & Wetterau, 2009; Gingerich, 2011), cost of equipping quality MT and its service (Attewell, 2005; Herrington, et al., 2009; Kukulska, 2010; UNESCO, 2011), lack of professional development (Naismith, Lonsdale, Vavoula, & Sharples, 2004; Shuler, 2009; UNESCO, 2011; Ferry, 2009), dangerous behaviors (Pew Research Center, 2009; Thomas & Bolton, 2012; UNESCO, 2011; Willard, 2011), as well as creating a new form of discrimination as related to the digital divide (Goad, 2012) (For a full discussion, see 2.3.4.2 below). These challenges were found to be crucial factors discouraging teachers from using MT in their instruction until they are well prepared (Goad, 2012; UNESCO, 2011; Shuler, 2009; Herrington, et al., 2009). Research and experience have shown that while MT offers many potential benefits to education, there are many challenges as well. This situation raised many questions about ‘What motivates teachers and what skills and knowledge do teachers need to adopt MT to improve students’ learning?  

1.2.2 Statement of the problem  

Summarizing contemporary research on factors affecting teacher use of technology in teaching and learning, Mumtaz (2000) reports that teachers’ skills and beliefs about the educational benefits of technology are important because teachers are the key players in changing and implementing technology in the process of teaching and learning. However, often the importance of teachers’ opinions and teaching role has been ignored in the integration process when a new technology, such as film in 1930s and television in 1960s, is introduced into the curriculum (Cuban, 1986; Saettler, 1990). As a result, technicians do not understand teachers’ needs and cannot provide appropriate resources to meet them. Due to inappropriate training and support and the lack of time to
prepare technology-based resources, it has been difficult for teachers to develop appropriate knowledge, skills, and resources to support their teaching with technology. Furthermore, in considering the use of the technology, teachers have not known the effects of the technology on students’ learning and thus resist integrating it into their curriculum. As a result, they were not motivated to innovate their teaching along with new technology (Cuban, 1986; Dockterman, 1989; Hruskocy, Cennamo, Ertmer, & Johnson, 2000; Levin & Wadmany, 2008; Mumtaz, 2000; Saettler, 1990). Research shows that teachers need appropriate knowledge, skills, and motivation to incorporate newly introduced technology into their teaching.

Research on MT has examined teacher opinions on using it with students for education (Goad, 2012; Herrington, Herrington, Olney, & Ferry, 2009; UNESCO, 2011). However, an understanding of self-reported teacher needs—knowledge, skills, and motivation—is routinely missing in teachers’ professional development to use technology in education and the use of MT in particular. This research addressed this problem through investigating what participants said they needed to use MT, the iPad in particular, in their teaching.

1.3 Purpose of the Study

Inspired by my personal experiences and coupled with research in the field reporting a lack of in-depth understanding of teacher needs, this study aimed to collect, analyze, and report teacher self-perceived needs for using MT in terms of knowledge, skills, and motivation. The reason to focus on the defined needs of experienced teachers who already have used MT for education is because their expertise is constructed based
on their practice in the classroom over time. Thus, they are the ones who understand the classroom environment and who know how to utilize learning materials to teach students with MT. Observing and understanding statements of the teachers’ needs can inform the field on the experiences using MT from the inside rather than from the outside as researchers, administrators, producers or educational technologists; this folklore approach, insider opinions, has been proven to provide an authentic perspective that should not be ignored (Baek, Jung, & Kim, 2008; Schrempp, 1996). The teachers’ observations and reflections on using iPads in education can contribute to an understanding of how education may improve through the use of MT.

1.4 Overview of Research

1.4.1 Research questions

This study investigated the perspectives of teachers who have used iPads in their classrooms at least one year. The overarching question was: which factors, related to knowledge, skills, and motivation, do teachers report as influential when using MT, specifically iPads, for educational purposes? The questions that guided this study are as follows:

- What components of knowledge do teachers think they need to use iPads?
- What skills do teachers think they need to use iPads?
- What motivates teachers to integrate iPads in the classroom?
1.4.2 Choosing a mobile device, iPads

This research studied teachers who had used mobile technology in the classroom. Among diverse mobile devices, such as iPhones, Android galaxy phones, and iPads, iPads were chosen for two reasons.

First, iPads were worthy of study due to their increasing popularity, ownership, and accessibility among teachers and students. Apple’s Marketing head Phil Schiller confirmed that more than 1.5 million iPads are used in educational institutions and schools (Apple, 2012). Researching schools’ adoption of mobile devices revealed that most schools that have implemented mobile devices district-wide selected iPads rather than any other mobile device, such as iPhones and Galaxy Tabs. Table 1 lists some schools that have utilized iPads in their curricula.

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Table 1: The List of Schools Using iPads
Second, I chose the iPad because of my workshop experiences with students in providing workshops to teach Kenyan students to use iPads in developing stories of foreign aid. The details of the project are described on this website, http://pamojatogether.com/. This experience had given me an understanding of advantages and challenges of using iPads with students. Because the researcher is the primary instrument that collects and analyzes data in qualitative research (Locke, Spirduso, & Silverman, 2007), the researcher's knowledge and background shapes the design and the interpretation of data. My workshop experiences enabled me to understand teachers' opinions more deeply and critically observe the classroom activities involving iPads.

1.4.3 Plan of inquiry

This is a qualitative case study. This approach provided a method to gain a valuable, deep understanding of teachers' self-perceived needs in context (Creswell, 2008, pp. 557-622).

To collect data, this study interviewed twelve veteran teachers experienced in employing iPads for at least one year to investigate their knowledge, skills, and motivation of using iPads. An interview guide of questions and topics to be covered during the conversation was employed throughout the research. This semi-structured interview format ensured consistency in the content of the questions, but also allowed participants to provide in-depth responses (Patton, 2002, p. 145 & 343; Turner, 2010). This approach facilitated gaining a deeper understanding of teachers' perspective.

To enhance the validity of findings, three sources of data—interviews, field notes,
and classroom document analysis—were employed to triangulate or cross-check each resource. These data enabled a better understanding of the classroom environment, infrastructure, and teachers’ reflections. The data was transcribed, coded, and analyzed for themes and patterns. The summarized, synthesized and organized key themes were classified into key factors of knowledge, skills, and motivation.

1.4.4 Significance of this study

This study determines what participating teachers perceived to facilitate the use of MT in the classroom: what teachers think motivates them, and what skills and knowledge teachers think they require. This in depth understanding of teachers’ perceptions and suggestions will inform the field’s understanding of the educational affordances and constraints of MT.

The potential benefits of this study are:

- Educational leaders may be able to use teachers perceived needs to make informed decisions on designing appropriate content for professional development to increase effective adoption of MT in the classroom.

- Educational technologists will know more about teacher needs as well as how to support their needs, which they could then use to provide more appropriate aid and resources.

- Teacher-perceived needs will help these technologists, administrators, and policy makers recognize challenges perceived by teachers and plan for addressing them.
As a result, the stakeholders will be able to design and implement more effective strategies and policies to take advantage of the uniqueness of MT that may improve and expand and enhance teaching and learning.

1.5 Summary

Overall, the purpose of this study was to bridge the gap between the established need for professional development and the emerging benefits of using MT for pedagogical purposes by identifying teacher perceptions of their own motivation, skills, and knowledge.

The literature review, Chapter 2, includes the definitions of terms and the history of educational technology to explain the importance of the teacher’s role in the integration process of previously introduced technology. This section also documents research about TPACK, a theoretical framework for understanding teacher knowledge required for effective technology integration. Lastly, the literature review documents current studies on the use of MT for educational purposes to examine its potential benefits, challenges, and suggestions that have been made.
CHAPTER 2

2 LITERATURE REVIEW

This chapter is divided into four sections. It reviews the literature in terms of four different areas: (1) definitions of terms and (2) the history of educational technology to address the importance of the teacher’s role in the integration process of technology; (3) the rationale for using Mobile Technology (MT) in the classroom by examining the definition, benefits, and challenges of MT; (4) TPACK theoretical framework is presented to examine an important model of teacher knowledge required for teaching efficiently.

2.1 Definition of Terms

The purpose of this section is to describes educational and technical terms to clarify the meaning throughout this paper. Each term is alphabetically ordered.

*Digital Media Literacy* skill includes ability to identify and use technology efficiently as a tool to research, organize, evaluate, and create, and communicate information (Jenkins, 2009; New Media Consortium, 2005; Partnership for 21st century skills, 2003; US Digital Literacy, 2014).

*Digital Citizen* refers to person who has the digital literacy skill as well as who understands rights, responsibilities, etiquette with regard to technology use (Hobb, 2010; Massachusetts Department of Elementary and Secondary Education, 2013).

*Educational affordances* refer to technological characteristics of devices, that learners can use while they engage in their learning activities (Tovar, 2009).
Hand-held means a device that is designed to be held and to be used in a hand (Oxford Dictionary, 2013).

*iWork* is an office suite of application (apps) created by Apple. It includes a presentation program called *Keynote*, a word processing called *Pages*, and a spreadsheet application called *Number*. The equivalent *iWork* applications are *Microsoft Office Mobile* applications for android, such as Microsoft Word and Microsoft PowerPoint (Apple, 2014)

*Mobile technology* (MT) refers to portable computing devices, such as iPhones and iPads. It combines PDAs, portable media players, digital still cameras, video cameras and GPS navigation features as well as communication services such as phone calls, text-messaging, and emails. MT also has a touchscreen and a web browser that allows users to access web information. Users can download free or paid applications from online stores and are able to use MT to create, store, access, modify diverse types of data, such as Word document, PDFs, and HTML (Tyler, 2002)

*Mobile Learning* (*m-learning*) is a learning process that refers to the personalized, connected, and interactive use of mobile devices for learning purposes in and out of classrooms (Perry, 2003). M-learning devices include wireless technological devices, such as Smartphones, tablets, personal digital assistants (PDAs), and laptop PCs, but not desktop (Traxler, 2007).

*Multimedia message service* (MMS) allows users to exchange graphics, video clips, sound files and short text messages over wireless networks. A big difference between email and MMS is that MMS does not support attachments as an e-mail does.
Network describes more than two interconnected computers that can share electronic resources like data, applications, office machines, and Internet connection (Meyers, 2012).

Short message service (SMS) allows users to send and receive text messages using their mobile technology (Webopedia, 2013).

Skill is the proficiencies developed through training or experience. Using the ADDIE example, the employee has demonstrated skills in applying the ADDIE model when designing training programs. Skills are usually something that has been learned. So, we can develop our skills through the transfer of knowledge (LAUBY, 2013).

Teacher motivation refers to teachers’ willingness to (1) improve their knowledge to integrate technology for teaching and (2) increase the use of technology in the classroom (EducationWorld, 2010).

Teachers are experts who are knowledgeable about learning theories, instructional methods, and potential use of diverse technology. They are “critical thinkers and active constructors of knowledge.” This view is different from viewing teachers as technicians who operating and applying technology in the classroom (Levin & Wadmany, 2008, p. 236).

Teacher Role refers to teachers’ instructional role. Teaching involves the following seven tasks: (1) acquiring relevant knowledge about students, (2) aligning learning objectives, assessments, and instructional activities (3) articulating explicit expectations regarding learning objectives, (4) prioritizing the knowledge and skills that students should focus on, (5) recognizing and overcoming their expert blind spots, (6)
adopting appropriate teaching instructions to support learning goals, and (7) involves progressively refining courses based on reflection and feedback (Carnegie Mellon University, n.d.).

*Technology* refers to "machines or tools designed to accomplish a specific task or tasks (Lam, 2000). In this study, the word *educational technology* refers to any machines that can be used for teaching.

*Wireless* means there is no physical wired connection between senders and receivers. Instead, it allow data transmission over unbounded media, such as radio waves and microwaves (Meyers, 2012)

### 2.2 Importance of Teacher Skills, Knowledge and Motivation: Lessons from the Early Use of Educational Technology

Previous research has found benefits of using technology in teaching and learning. However, the history of educational technology has shown that when teacher opinions and knowledge have been ignored in the integration process of technology, teacher use of technology in the classroom is limited and infrequent (Clark, 1994; Cox & Graham, 2009; Cuban, 1986; Hruskocy, Cennamo, Ertmer, & Johnson, 2000; Mumtaz, 2000; Saettler, 1990; Williams, Coles, Wilson, Richardson, & Tuson, 2000). Often when new technology develops, technology-advocates seem to believe new technology can revolutionize schooling and educate students more productively and effectively. (Clark, 1994; Cuban 1986; Dockterman 1989; Saettler, 1990) This, called the "bandwagon effect" (Calhoun, 2002, p. 32), influences stakeholders’ decisions and puts improper emphasis on developing and equipping hardware in the classroom rather than on helping
teachers prepare corresponding skills and knowledge for integrating the technology into their teaching and learning processes. Teachers often did not understand its effectiveness and were not motivated to use technology to improve education as much as advocates expected (Saettler, 1990; Cuban, 1986).

The purpose of this section is to address the strengths and weaknesses of the technology integration process, particularly film, television and computers throughout the history of educational technology. This review will help determine past mistakes to prevent the repetition of those in the future MT integration process.

2.2.1 The use of film in classrooms

Educators have long promoted the use of visual aids in instruction. Using visual aids, teachers can bring concrete and realistic examples to the classrooms to support their verbal lectures, for example the use of Comenius’ first illustrated textbook, Orbus Pictus (The World in Pictures) to teach Latin. In the 1900s, the development of film stimulated the use of visual aids in schools. Pioneers and inventors of film believed that film could support the educational process by opening possibilities for teachers to show visual examples of spoken and written words and could educate students more effectively (Hammond, & Lee, 2010; Saettler, 1990, pp.96-99; Cuban, 1986). In 1913, Thomas Edison, a technology inventor and enthusiast, overestimated that “Books will soon be obsolete in the schools. Scholars will be soon instructed though the eye. It is possible to teach every branch of human knowledge with the motion picture” (quoted in Saettler, 1990, p. 98). However, Edison’s and other advocates’ optimistic prediction that film
would revolutionize education proved to be incorrect (Benjamin, 1988; Lumsdaine, 1961).

In 1922, W.M. Gregory reported the limited use of instructional film in classrooms due to poor quality. Much research was done to find more detailed reasons for the failure. A Yale University research team examined the value of film in 7th grade history classes. Through their observation, they found that film was a good teaching tool to economize instructional time and effort, and to stimulate students’ interest. However, the effectiveness of instructional film was only attained when teachers were motivated adopting the medium in teaching and when film was accompanied by “good teaching” (Saettler, 1990, p.227). This research shows the importance of teacher skills and motivation to strengthen the effectiveness of film in the classroom through integrating the technology into their content and teaching processes.

Later research further illustrates the failure of using film in instruction due to lack of teacher motivation and producers’ understanding of teacher need. In 1937, Rockefeller Foundation asked McClusky to investigate the failure of instructional film. According to his study, there was a lack of coordination between educators and film producers. Film producers focused on the cost benefit rather than educational benefits, so they could not clearly define the educational purpose of film. Because producers failed to communicate with teachers, they could not understand teacher needs nor develop films that supported lessons. Because teachers could not find appropriate films that fit into their curriculum, they were not motivated in using the medium in the classroom (Saettler, 1990). This research emphasizes the importance of teacher involvement in the production of
educational film, as one example of educational technology, to improve the quality of its content and to increase the benefits of teacher interest in utilizing educational film in the classroom.

Cuban (1986) investigated difficulties in using instructional film and reported similar but more detailed reasons for teachers’ limited use. To discover these facts, he examined surveys that were conducted by Edgar Dale in 1954 and the National Education Association (NEA) between the 1930s and the 1950s. Based on his analysis, he reported four causes for the infrequent use of film. The first was teachers’ lack of skills in using film and equipment. Second, the cost of film, equipment, and maintenance was higher than expected. Third, teachers had difficulty accessing films when they needed them. Lastly, teachers could not find appropriate films that fit into their lessons (Cuban, 1986). Cuban’s research not only shows the importance of teacher skills and involvement in the development process of educational film, but also illustrates the importance of technical and economical support, and training to prepare teachers with corresponding skills to use technology.

Film could not be integrated into classroom practices as advocates expected due to lack of access, teacher motivation, and skills. These findings show that film could be a valuable teaching tool if teachers had training and support, which is further supported by the use of educational television in the classroom.

2.2.2 The use of television in classrooms

The introduction of instructional television highlighted the same issues as film when it entered the classroom to solve the teacher shortage problem. Promoters argued
that using educational television (ETV) could make superior teaching widely available to students and could educate students more productively at a lower cost (Reiser, 2001; Benjamin, 1988; Gordon, 1970). However, by ignoring the importance of teacher instruction and implementing ETV, it faced similar limitations as film. Three patterns describe how ETV was used in classrooms: (1) total instructional programs presented by studio teachers, (2) supplemental television instruction, and (3) television as a teaching aid (Saettler, 1990; Cuban, 1986).

In the 1950s, the St. Louis schools and St. Louis educational commissioners used the first pattern to create television programs to teach 9th grade English classes. The lessons were exclusively delivered over television. Students were required to watch television lessons for 30 minutes, five days in a week. Classroom teachers acted as supervisors and the television program, delivered by a studio teacher, carried the burden of instructing students. Through this experiment, researchers found that televised lessons could not carry "the complete instructional burden" and television lessons should be accompanied with classroom teachers' follow-up instruction (Saettler, 1990, p. 367). This research emphasized the importance of the classroom teacher's role to successfully use technology for teaching.

In the early 1960s, the American Samoan Project also used the first pattern to develop television lessons. H. Rex Lee used ETV programs in an effort to meet teacher shortages. Producers and studio teachers designed and developed ETV programs, and delivered the packets to the classrooms with printed instructions. These instructions described what classroom teachers needed to do to prepare ETV programs in classrooms.
and what they needed to do after watching the programs; teachers simply had to follow
the instructions they were given. Unfortunately, teacher expertise was completely ignored
in the development of these programs. In 1972, a survey was conducted to examine
teacher and student opinions of the use of Samoan ETV programs. Both teachers and
students expressed strong resistance to continued use of the telecasts as the primary
medium of instruction. In 1973, the Samoan school officers shifted the authority from the
studio to classroom teachers.

Six years later in 1979, Wilbur Schramm and his colleagues examined the use of
the Samoan ETV programs. They found that teachers seldom used the programs in
classrooms (Cuban, 1986; Thomas, 1980). Based on their findings, Schramm et al. made
suggestions to improve the efficacy of using ETV programs. First, producers should
coopcrate with classroom teachers in the production and integration process. Second,
programs should be tried and tested before they are manufactured and introduced into
classrooms. Third, producers should seek teacher feedback and advice to determine
teacher needs to use technology in classrooms (Saettler, 1990).

The St. Louis and Samoan projects clearly illustrate the ineffectiveness of ETV
programs in learning when the medium is developed and used without understanding the
importance of teacher expertise. Based on these findings, one should be aware that
television cannot act as an instructor if teachers are not motivated in adopting ETV in
teaching.

The Washington County Maryland project was developed differently than the St.
Louis and Samoan projects. Washington County school officers and Fund for
Advancement of Education (FAE) agreed to develop televised lessons to meet the pressing needs of overcrowded classrooms, and untrained, uncertified teachers. They decided to develop a closed-circuit television program as supplementary teaching aids in four major areas – arithmetic, art, science, and music. Classroom teachers, studio teachers, and producers collaborated as a team to design and develop the lessons. The school superintendent emphasized both the importance of classroom teacher follow-up instruction and the role of ETV as a supplementary teaching tool. Frequent teacher assessments were used to develop teacher education and to prepare teachers with appropriate knowledge to use ETV in the classroom. In addition, teachers had opportunities to attend training in the use and value of ETV programs during the summer vacation (Cuban, 1986). Saettler and Cuban reported that the experiment was successful. Standardized test scores substantially improved compared to groups exposed to ETV as opposed to those not exposed. All user groups – teachers, students, and parents – favored the use of ETV programs in instruction.

Comparing the success and failure of instructional television programs has shown that teacher skills and knowledge play an important role in designing and integrating ETV in the instructional system. Teachers have become more motivated in using technology in instruction when they know how to use technology for teaching. These studies above have shown that, educational leaders and teacher professional providers should seek teacher required knowledge in designing training programs in order to appropriately support and motivate them to use MT with their students.
2.2.3 The use of computers

The use of computers shows the same pattern as film and television. Advocates claimed that traditional instruction was obsolete and pressured teachers to embrace the use of computers in the classroom. They saw computers as a tool to transform lesson content and believed that schools could educate children by “wiring schools and equipping them with computer stations” delivering drill-practice tutorials (Cuban, 2001, p.17). They believed that increased availability of hardware would increase the use of technology, which would lead to effective and efficient teaching and learning. For example, Papert, an advocate of the use of computers in schools, overemphasized the efficacy of the use of computers for learning and predicted that

There won’t be schools in the future… I think the computer will blow up the school. That is, the school defined as something where there are classes, teachers running exams, people structured in groups by age, following a curriculum—all of that. The whole system based on a set of structural concepts that are incompatible with the presence of the computer….But this will happen only in communities of children who have access to computers on a sufficient scale (cited in Cuban 1986, p.72).

However, this promising potential of computers did not pan out. After researching the reasons for teachers’ lack of using computer in the classroom, Papert found that the failure of educational use of computer in the classroom was due to ignoring the importance of the teacher role. He notes that when researchers were asked to answer why school failed to adopt computers in the classroom, they said
"schools don't know how to use the computer"; and they propose to remedy this by more research on methods of using computers, by developing more software, especially software that will be easier to use, and by setting up channels of dissemination of knowledge about computers. They are fundamentally wrong. Of course, research will increase the variety and effectiveness of uses of computers, but this is not what will change the nature of computer use in schools" (Papert, 1993, p. 39).

Based on his research, Papert stresses that technicians need to understand teaching is a “creative role” (Papert, 1993, p. 70) and need to cooperate with teachers to determine their needs in order to improve education through using computer.

In the late 1990s, to investigate this potential, Cuban (2001) examined the use of computers in primary, secondary, and tertiary Silicon Valley classrooms, investigating who used computers, how they were used, for what purposes they were used, and with what frequency. He found the use of computers in classroom environments for direct classroom instructions for three school levels was limited. He reported teachers’ infrequent and limited use due to lack of skills, support, and unsatisfactory software. Most of the faculty had difficulty in understanding how to use technology to support their instruction. So they used them for preparation of materials rather than instructional purposes (pp. 129-130). Educators were optimistic about the potential of computers similar to the development of film and television. However, Cuban found that when educators focused on product, i.e. on the equipping computer, rather than prepare
teachers with adequate skills to use the new technology, computers did not benefit teaching and learning.

Cuban's conclusions were suggested by other researchers who examined the same line of studies. Integrating technology into teaching requires a major adjustment to teaching practice (Lam, 2000, p.393; Dexter, Anderson, & Becker, 1999). A technology just added on to an existing curriculum has been shown to have only a marginal effect. To improve teaching by integrating new technology, Dockterman emphasizes the need for systematic instructional design and the implementation process to maximize the benefit of using technology for education. He also suggested that teachers should be integrators of instructional technology. Teachers know what to do with technology to facilitate students' cognitive learning processes and critical thinking. Therefore, understanding teachers' needs and helping them prepare with the right skills are important when introducing new technology in the classroom (Dockterman, 1989a; Dockterman, 1989b).

Numerous researchers continuously have examined the integration process of later technology, such as more advanced computers, in education. They reported the consensus result, the importance of the role of teacher motivation, skills, and knowledge in the technology integration process (Bitner & Bitner, 2002; Levin & Wadmany, 2008; Mumtaz, 2000; Scrimshaw, 2004; Totter, Grote, & Stütz, 2006). To use technology for teaching, teachers need to know not only how to operate, but also how to utilize technology for teaching. The study of Totter, Stutz, and Grote (2006) is an example. They have examined the six positive and negative factors that influenced teachers' use of new
media. The six factors are (1) openness to change, (2) willingness to cooperate, constructivist teaching style, (3) lack of time to learn, (4) lack of time to prepare instruction with technology, (5) lack of ICT confidence, and (6) lack of ICT competence. Three factors—openness to change, willingness to cooperate, constructivist teaching style—showed positive effects on the teachers’ use of new media. The other three factors—lack of time, ICT confidence, and competence—had negative effects. Among six factors, particularly three factors, constructive teaching style and lack of time to learn and prepare the technology for teaching was particular predictive value with the teacher use of new media. Based on their findings, they emphasized the importance of developing teachers’ both ICT and pedagogical-skills in order to enable teachers to use new media in a constructive way.

Based on the reviews of the educational use of technology, it is clear that teacher motivation, skills, and knowledge are key factors that influence the use of technology in teaching. Testing the needs of these three factors to adopt more advanced technology will not further educators’ understanding of technology use in teaching and learning. Instead, researchers should identify the components of, knowledge, skills, and motivation that are related to teachers’ use new technology in education. Understanding teacher needs and statements will enable educators to make an informed decision in designing appropriate training and encouraging teachers to use newer technology to support their instruction.

2.2.4 Summary of educational technology

The review above highlights the teacher knowledge, skills, and motivation are crucial to achieve effective technology integration in the classroom because teachers are
arguably the most knowledgeable about their own classroom contexts and their own curriculum management to engage students. Advocates have claimed that new technology can improve schooling and educate students more productively and effectively. However, as we have seen in the history of educational technology, involving educational film, television, and computer, more sophisticated technology cannot automatically create a more effective learning environment. The greatest probability of effectiveness in using technology to improve education is when the teachers are ready to use technology with “adequate instructional methods” (Clark, 1994, p. 27). Also, it is necessary to identify teacher needs to provide appropriate support in using technology to improve teaching and learning. Following these guidelines, based on the history of educational technology, will enable educators to bring together the best of old and new technology to support teaching and learning successfully.

The next section discusses the research to locate potential factors that can influence teachers’ use of MT by examining the definition, benefits, and challenges of MT and relates it to the historical lessons learned we have just described.

2.3 Mobile Technology for Education: Definition, Rationality, Benefits and Challenges of Using MT in the Classroom

While the previous sections provided a historical overview of technology in the classroom and discussed the factors that influence the effective integration of technology in the classroom, this section reviews the literature in the use of MT for education to ascertain the current state of knowledge and research of MT, including the definition of MT, the rational to focus on MT, and its benefit and challenges in teaching and learning,
Also, this section presents current teacher and student opinions on using MT in teaching and learning based on evidence given through interviews and questionnaires. While this is likely to give a clear picture of teacher opinions, which are integral to the effective integration of technology, this section also considers the student opinions who influence teacher motivation on the use of technology.

2.3.1 Concept of MT

The uses of the term mobile technology (MT) is vague and various. Thus, clarifying the definition of MT as it is used here is important to classify types of mobile devices and to discuss the influence of different mobile devices on teaching and learning. In this paper, I define the term of MT by (1) identifying the elements and ability of “mobility” and (2) examining the meaning of “mobile” from a technical point of view.

Three elements of “mobility” are examined to address its unique characteristics as compared to wired technologies, such as desktop computers. The technical viewpoint of “mobile” is used to classify the types of different mobile devices.

Seppälä and Alamäki (2003) examined three elements of mobility that are valuable in teaching and learning to define MT. These three elements of mobility are convenience, expediency, and immediacy. Convenience of MT refers to easily carriable and handy features of MT that enable users to access MT at the moment of their needs. Expediency refers to versatile of MT, which enable users to use MT to achieve their diverse purposes, such as taking notes and taking pictures, even while moving. Immediacy refers to the communicability of MT, enabling people to interact with others without intervening time and space. These three elements of mobility are important to
note when defining MT in teaching and learning because they highlight the accessibility of digital teaching and learning resources across time and space, enabling for teachers and students to interact and work when they want to (Seppälä & Alamäki, 2003). This "anytime, anywhere" accessibility, versatility, and communicability concepts are valuable to include within the definition of MT herein because it distinguishes MT from wired technology. Examples of mobile devices fitting this definition include laptops, tablets, and cell phones.

Eric Klopfer (2012), who focuses on researching the efficacy of using mobile games, examines the meaning of mobility from its ability and narrows down the types of MT. According to Klopfer, "mobility requires the ability to casually use a device on the go — without sitting down (Klopfer, 2012)" Thus, considering the ability of mobility, devices like laptops are limited in the degree to which they may be categorized as mobile devices.

Researchers also interpret the meaning of "mobile" from a technological point of view to define MT as a hand-held and wireless network technology (Kim, Mims, & Holmes, 2006). Adding two more features—hand-held design and wireless connection—helps to further subcategorize diverse mobile devices. Synthesizing the concepts of mobility, types of mobile devices are reduced down to smart devices, such as smartphones and tablets, which are both capable of advanced computing.

Later research addresses one more aspect of MT, portability, to describe MT (Naismith, Lonsdale, Vavoula, & Sharples, 2004, p. 2). However, the portability is equivalent to mobility, so the word portability does not included in the definition of MT.
in this paper because the concept neither add any new criteria of MT in order to
differentiate it from wired devices nor sub-divide the types of mobile devices.

In summary, the definition of MT in this paper is defined as a convenient,
expedite, and immediate hand-held and networked computers that enable users to access
information and communicate with others while on the go. While MT can be described in
many different ways, for the purposes of this dissertation, MT refers to more advanced
smartphones and tablets, like iPhones and iPads.

2.3.2 What makes MT viable as an educational tool

Before examining the benefits and challenges of MT, I want to justify the need to
pursue the possible use of MT in teaching and learning. I identify three conditions that
may encourage the use of MT in the classroom: 2.3.2.1 increased ownership of MT
among teachers and students, 2.3.2.2 increased teacher motivation due to increased
student capability, and 2.3.2.3 unique affordances of MT.

2.3.2.1 Increased ownership of MT among teachers

One issue in the use of technology has long been teacher comfort level with the
technology itself (Gülbahar, 2007; Jones, 2001; Totter, Grote, & Stütz, 2006). The
ubiquity of MT for personal use provides teachers with both familiarity with the
technology and a certain comfort level in using it, a phenomenon resulting from
significantly reduced cost of both mobile devices and services (Kim, Mims, & Holmes,
2006; Pietrzyk, Semich, Graham, & Cellante, 2011; Thornton & Houser, 2005).

According to Pew Research Center (2012), 88% of American adults have a cell phone (p.
2), and of those, 46% have a smartphone (p.4). Pew researchers (2013a) also surveyed the ownership of Advanced Placement (AP) and National Writing Project (NWP) teachers. They found that 94% of these teachers own a cell phone, which is slightly higher than the national figure of 88% for all U.S. adults (Pew Research Center, 2013b, p. 15). As a result, it can be assumed that most people, teachers included, own a mobile device, which enables them to continuously explore its functionality and remain comfortable using it as new features develop. These experiences can help teachers increase their competence and confidence in operating MT, which helps the transition from personal use of MT to educational use. It is this unique feature of MT that makes it intriguing for educational purposes because teacher familiarity with technology is an important factor when adopting new technologies (Jones, 2004).

2.3.2.2 *Increased teacher motivation due to increased student accessibility and capability*

Increased student accessibility and capability has extended the potential for using MT as an educational tool because unlike most previous technology like television and desktop computer for educational use, most students have their own MT and are already comfortable using it. Due to the decreased cost of MT, most students have their own MT, which enhances the level of personal access for MT. This convenient accessibility of MT allows students to routinely use it to communicate with their friends and families, plan their lives, or look for information (Pietrzyk, Semich, Graham, & Cellante, 2011; Shuler, 2009; Thornton & Houser, 2005; Prensky, 2004; Wagner, 2005). Students, having grown up with the existence of MT as tablets and cell phones, are both highly motivated to use
technology for social purposes, and are capable of modifying their use of MT itself changes and grows. As a result, members of the young generation, who are often referred to as “digital natives”, have quickly adopted it in their day-to-day lives and become competent using MT (Klopfer, 2012; Naismith, Lonsdale, Vavoula, & Sharples, 2004; Prensky, 2004; Shuler, 2009).

This increased student capability can have a positive effect on teacher interest, further contributing to the viability of MT in teaching and learning. Hurskocy et al. (2000) provides a training program for students to examine the effect of student technical skill on teacher technology implementation in the curriculum. They report that increased student technical skills and knowledge during the program also increased teacher motivation to learn about and use new technology with students. As Hurskocy et al. (2000) reports, this positive influence of the student training program on teacher integration of technology has been expressed well from various in-school stakeholders: A librarian commented that “as the program progressed and student enthusiasm increased, [teachers] began to join in”, a principal summarized the overall effect that “…[the training program] has increased technology use many-fold” and an instructor commented on increased teacher willingness, “I believe I’ll use our technology more next year because the class will know more from the start” (p.78). This evidence that teachers are motivated by increased student capability of using technology shows a potential positive influence on teacher motivation to integrate MT in the classroom and therefore, its viability as an object of research.
2.3.2.3 Unique affordance of MT: portability, social interactivity, context sensitivity, connectivity, and individuality

The evolution of MT has brought five unique affordances for learning, which adds to the viability of using MT as a teaching and learning tool. One early study of MT highlights its unique affordances. Eric Klopfer and Kurt Squire (2007) experimented with the use of MT to improve environmental engineering learning, and outlined these five unique affordances of MT: portability, social interactivity, context sensitivity, connectivity, and individuality. In this section, I discuss each affordance to examine the potential value of MT in teaching and learning.

First, as technology has developed, MT has become portable with more computational power compared to early mobile devices. The size and weight of mobile technology has become significantly reduced. For example, the first mobile phones, called ‘bricks’, weight about 2 pounds (907 grams) whereas the heaviest modern mobile phone is merely 114 grams, which is about 13% of reduction (Balakrishnan & Yeow, 2008). Also, faster microprocessors and larger memory within MT enable people to transfer, edit, and organize a large amount of data on their MT. This advanced computational capacity allows people to use MT in much the same way as they used laptop systems. As a result, unlike other wired devices like televisions and desktop computers, students and teachers can easily carry these portable computing devices anywhere they go and enjoy using computers’ functionalities as they need (Prensky, 2004). Because MT can support learning in and outside of the classroom, the portability adds another reason for exploring MT as an educational tool.
Second, MT supports social interactivity among teachers and students by providing diverse communication channels. Using message apps, people can make a phone call, send and receive emails, exchange text and multi-media messages, like videos, to communicate with each other anytime they want (Pietrzyk, Semich, Graham, & Cellante, 2011). Also, the accessibility of the Internet on their phones provides further link to online social networks such as Facebook, which provides another way for people to interact. The social interactivity on MT can stimulate communication between teachers and students and support teaching and learning in various environments (Shuler, 2009).

Third, MT enables learners to gather context sensitive data that is unique to a user’s location, time and environment, unlike other wired devices. Using sensors within their MT, students can collect scientific data like temperature, acceleration, and wind speed while they are conducting experiment in a field (Squire & Klopfer, 2007). Using a built-in camera and microphone on a cellphone or a tablet, each student can document learning events related to their subjects. Students can examine this data later when they are back into the classroom and use it to aid in analysis and reflection. This experiences can help students link outside of school context and their school subjects, which is arguably either unfeasible or at least problematic without MT (Pattern, Sanchez, & Tangney, 2006, p. 303).

Fourth, wireless network connectivity of MT allows students and teachers to work in many more places than they could with wired technologies. For example, students and teachers can store their learning resources on cloud storages like Dropbox or Google
docs, and access them when and where they want. This convenient accessibility and portability enable teachers and students to complete tasks, even during a train commute, helping them use their time more flexibly and efficiently than before (Seppälä & Alamäki, 2003).

Lastly, mobile devices generally belong to an individual. Thus, MT can be customized to an individual’s needs by storing personal information and by installing necessary mobile applications. For example, students can download notebook applications to take class notes. Using calendar applications, students can store school schedules and use it as a reminder of school events to manage their time conveniently (Kinshuk & Chen, 2005; Pattern, Sanchez, & Tangney, 2006). Also, using educational games and scores on personal MT, teachers can track individual learning progress and provide tailored instruction (Goad, 2012). Adding the individuality of MT to previous affordances enhances the value of MT as a potential educational tool.

As explained in the sections above, because teachers and students largely own and use mobile devices and because MT offers five unique affordances for learning, it has been shown that MT offers potential benefits in learning, providing support for the rationale that it is worth studying the use of MT in teaching and learning. The next section examines student opinions of using MT to understand what influences the teacher motivation on the use of technology.

2.3.3 Students perspective on the use of MT

Students’ positive opinions and enthusiasm on the use of technology is one important factor that stimulates teacher motivation to implement technology as discussed
the above (For detailed discussion, see 2.3.2.2 above). Thus, it is important to examine current student opinions of using MT in their learning process.

Recently, Project Tomorrow (2012) studied K-12 student use and opinions on using mobile technology for learning. Sixty-seven percent of students have a Smartphone, three times more than in 2006 (Project Tomorrow, 2012, p. 5). Students perceive mobile technology, such as tablets and Smartphones, as an important tool to help them accomplish schoolwork and be self-directed learners. Students said that a major obstacle in using mobile technology for their learning activities was school policies that prohibit the use of personal mobile devices in the classrooms. Students recommended schools adopt the technology to change the “traditional classroom paradigm” (Project Tomorrow, 2012, p. 5).

In 2012, the EDUCAUSE Center for Applied Research conducted a similar survey among 100,000 college students around the world. Sixty-two percent of students own a Smartphone, and 15 percent of students own a tablet (EDUCAUSE CENTER, 2012, p. 14). Students report that they access their academic information, such as campus news, grading, and course schedules, using university mobile applications; they also use their personal mobile technology to read, write, and learn about course materials. Students prefer the convenience of portable devices, which allow consistent access to course resources. College students recommend that instructors integrate mobile technology, for example preparing learning content to be as easy to access and view on a mobile as on a computer, so that students not only can conveniently access to school
documents but also can improve their technical and digital literacy skills while studying (EDUCAUSE CENTER, 2012).

Research has reported that students prefer and support the use of convenient and portable MT to complete their schoolwork compared to wired technology like desktop computers. To meet the students’ expectation of school system and to prepare adopting MT in formal education, it is important to understand the benefits and challenges that have been reported by educators, presented in two sections below.

2.3.4 Educational benefits, challenges and suggestions

With increased ownership of MT, increased capability of users, the unique educational affordances of MT, and student enthusiasm to use it, educators have wondered how to harness the innovative features of MT to support teaching and learning. Early research found that mobile technology can help students acquire basic literacy and deepen their understanding of science, technology, engineering, and mathematics (STEM) subjects, as well as improve technical and critical thinking skills (Dahlstrom, 2012; Goad, 2012). However, previous research also reported some drawbacks, such as accessing inappropriate or incorrect information (Goad, 2012), classroom distraction (Campbell, 2006; End, Worthman, Mathews, & Wetterau, 2009; Gingerich, 2011) and dangerous behaviors (Pew Research Center, 2009; Thomas & Bolton, 2012; UNESCO, 2011; Willard, 2011). This section synthesizes the literature to present the benefits, drawbacks, and suggestions to gain a better understanding of the use of MT.
2.3.4.1 Educational benefits

Proponents have examined the usage and influence of MT in teaching and learning (Cobcroft, Towers, Smith, & Bruns, 2006; Goad, 2012; Jacobs, 2011; Kim, Mims, & Holmes, 2006; Klopfer, 2012; Seppälä & Alamäki, 2003); the following common benefits of using MT are identified in these studies: (1) supports anytime, anywhere learning, (2) supports collaborative learning activities, (3) promotes personalized learning experiences, and (4) creates a constructive learning environment.

2.3.4.1.1 Anytime, anywhere learning

Mobile technology provides “anytime, anywhere” access to educational resources to support learning activities. To explain the significance of “anytime, anywhere” learning, I turn to educational philosophy. Tyler (1969), called the grandfather of curriculum design, claims that teachers need to provide learning activities in their curricula that help students understand and acquire information, such as terms, ideas, and principles.

Tyler provides four strategies to help students learn information. First, teachers can provide information when students need the information to solve a problem. Second, teachers can select important information that students need to remember and frequently use in their lessons. Third, teachers can set up a memorable situation that will stimulate student learning of information and leave a positive impression. Lastly, teachers can use information in diverse contexts to help them retain the information. MT can benefit curricula because it gives teachers a way to provide anywhere anytime learning experiences, as Tyler suggests, to help students obtain information (pp. 68-82).
Portable MT facilitates teaching and learning independent of time or location. This educational process is also referred to as ‘mobile learning’ (Traxler, 2007, p. 7) or ‘always-on learning’ (Cobcroft, Towers, Smith, & Bruns, 2006, p. 25). Using ubiquitous MT, students can conveniently access the Internet and find information to acquire new knowledge as they need it (Kinshuk & Chen, 2005). This accessibility enables students to choose when and where to study, or to study a subject immediately in context, increasing the productivity of learning activities (Cobcroft, Towers, Smith, & Bruns, 2006; Pietrzyk, Semich, Graham, & Cellante, 2011). As Tyler notes, this ‘just-in-time’ learning can help students learn new knowledge in authentic contexts, which helps them link real life examples to school subjects to gain a deeper understanding of theoretical concept that they have learned in the school (Mifsud, 2002).

The case study of Thornton and Houser (2005) is a good example of how “anytime, anywhere” access to MT benefits the acquisition of vocabulary in an English language program. The purpose of this study was to examine the efficacy of using MT to promote the daily study of vocabulary. The experimental and control groups were tasked with acquiring 10 new vocabulary words over the course of two weeks, five words per week. The experimental group was “mobile emailed” three times each day with a short paragraph utilizing the target words (at times as few as two and at times as many as five), providing significant exposure to the target vocabulary. The control group received the same ESL vocabulary materials, but the delivery was different. The control group was given one list of information, including all the words and paragraphs, on paper in class.
and on a website. While the experimental group was sent small bits of information several times every day, the control group was provided information only once per week.

After two weeks, Thornton and Houser conducted follow-up studies of the experimental and control groups. They examined the learning outcome by comparing the pre- and post-test results of the target and the control groups. The test scores revealed that students who received mobile lessons learned more ($p<0.005$).

The researchers also conducted a follow-up survey to examine student opinions. They found that 93% of students who received their lessons on mobile devices reported that mobile lesson was valuable. 57% of students said that after they received the mobile lessons, they could wait until they had some time, typically while commuting, to concentrate on studying. 89% wished to continue the mobile lesson. 69% said small screen size was not a problem.

This study shows the potential of using "anytime, anywhere" accessible MT as a 24/7 learning content delivery tool to stimulate students to study subjects. Teachers can use MT as a new way to support learning exercises outside of the classroom and facilitate learning practices in student's daily lives to help them retain content better. By providing lessons on a daily basis using mobile devices, students are more motivated and enjoy the memorable learning activities as is suggested by a curriculum expert, Tyler. However, to design and deliver mobile learning content, teachers will need adequate pedagogical and technical training.

2.3.4.1.2 Collaborative learning

Before we examine how MT supports collaborative instruction, it is important to
understand the meaning and efficacy of collaboration in learning. Collaborative learning is an instructional method in which a group of students exchanges, modifies, and develops its ideas in order to achieve a learning goal (Gokhale, 1995). The benefits of collaborative learning have been studied by many scholars. First, in collaborative learning environments, students perceive their peers as a source of knowledge and help each other rather than compete (Zurita & Nussbaum, 2004). Second, while exchanging and negotiating their opinions, students can practice how to articulately convey their opinions and enhance their communication skills. Third, an experimental study focused on examining the impact of communication during the learning process found that building their understanding through this communication process can help learners acquire and recall knowledge better in memory systems, (Hollingshead, 1998). Lastly, this social interaction enables students to “organize their own activities according to a social form of behavior,” which helps them build appropriate social attitudes (Vygotsky, 1978, p. 14) and critical thinking skills (Shuler, 2009). In sum, collaborative learning, which involves communication, negotiation, and interaction in teaching and learning, helps students achieve meaningful learning by underpinning the process of knowing, perceiving, and remembering new knowledge through communication.

Unlike wired technology, which is constrained to a physical location, mobile devices facilitate the collaborative learning environment by allowing learners to share ideas and information beyond the classroom (Naismith, Lonsdale, Vavoula, & Sharples, 2004). Using email and text messages, students can exchange their inquiry and opinions with classmates and teachers to further understand content while outside of the
classroom. Also, when students find information that is useful for their group projects, they can record and share the information with their group and reflect on new knowledge together anywhere, at anytime (Naismith, Lonsdale, Vavoula, & Sharples, 2004; Shuler, 2009).

The case study by Seppälä & Alamäki (2003) exemplifies how MT benefits teacher training programs by supporting collaborative interaction as well as by providing convenient access to information. The aim of this study was to create flexible teaching solutions using mobile communication devices that support learning in diverse environments. Eleven student-teachers and five supervising teachers participated in this study. Student-teachers used mobile devices to take pictures of their training and upload both training session reports and pictures to the school database in order to share their experiences with their supervising teachers and other student-teachers. Supervising teachers used their mobile devices to access this content in the school database and leave their comments on student-teacher reports at their convenience. Also, supervising teachers sent notifications via text to student-teachers when their feedback was available.

The study reports that the student-teachers like to use MT because it helped them share teaching reports instantly and helped them communicate with supervising teachers and other peers when necessary. Using texts, student-teachers were able to share their thoughts immediately after attending peers’ training sessions. By viewing pictures and then discussing the successful elements and challenges of their lessons, student-teachers were able to solve teaching issues collaboratively to improve their teaching skills. Additionally, MT allowed them to use their “waiting moments” to complete their course
work (p. 333). For example, student-teachers could use their time on the bus or train to write field reports and upload their photos and notes from their MT to the file-sharing database for the course.

Supervising teachers also agreed that MT helped them use their time more flexibly. Using wireless networks on MT, they could access student-teachers' reports on the file-sharing database and could give feedback to students while traveling (p.333). In addition, supervising teachers pointed to the usefulness of camera features of MT. By enabling student-teachers to share pictures of teaching activities, supervising teachers were able to find mistakes that student-did not notice. This helped supervising teachers provide tailored feedback for each student to improve teaching skills.

This study shows that MT can be used as a collaborative tool in the teaching and learning process. Using diverse communication channels of MT, students can interact with their peers when they need and collaborate to achieve their learning goals beyond the classroom. In addition, they can carry a portable mobile device anywhere they go and access the educational resources to complete their course work whenever they are able to, helping them use their time more efficiently. To enable teachers to integrate MT in their instruction and to utilize collaborative learning, teachers will need appropriate support and training to learn the capability of MT and to redesign their lessons.

2.3.4.1.3 Personalized learning

Third, MT supports personalized learning by providing tailored lessons to each student. The efficacy of personalized learning was previously discussed by educational scholars (O’Keeffe, Brady, Conlan, & Wade, 2006; Sampson, Karagiannidis, & Kinshuk,
According to this research, personalized learning promotes positive learning outcomes because it customizes instruction and materials "based on an analysis of the learners’ objectives, current status of skills and knowledge, [and] learning style preferences", and so helps them achieve meaningful learning (Sampson, Karagiannidis, & Kinshuk, 2010, p. 25).

MT can support individual learning experiences. Using Internet capability of MT, students can instantly search for information that helps their understanding. This self-remediates learning process help students catch up lessons and keep them engaged. By using educational game apps and monitoring the scores, teachers can track each learner’s progress easily, and tailor their instruction for each student’s abilities, interests, and needs. Also, schools can deliver on each student mobile devices the same learning content using various media, such as text, audio, and video. This enables students to select educational resources based on their own learning styles (Motiwalla, 2007; Virvou & Alepis, 2005).

Marissa, an eleventh grade school student, explained how MT helped her individual learning. She took her English literature honor class, and one of her class lessons was about Hamlet. The classroom was formed with two activities, oral reading of Hamlet and classroom discussion. She was able to complete the first activity, reading Hamlet. However, Marissa could not understand the context of Hamlet because she did not know the meaning of certain old English words whereas her classmates seemed to be understood the context. The classroom discussion started, however, she could not participate in the discussion. The more she came to an understanding of the book, the
more she fell further behind the classroom discussion. To solve her problem, she used her smartphone to search about Hamlet quickly. After reading a couple of online information, she was able to understand the story and was able to join the classroom discussion.

Marissa’s story is a good example of how MT can support an individual student learning. By enabling students to look for certain information as they need, MT can help them catch up when they fall behind in the classroom activities and help them engage back into classroom activities.

Sesame Workshop’s IRead project is another good example of how to deliver personalized instruction using MT. IRead is a media-based literacy intervention app which is designed to improve students’ comprehension and reading. It examines student user data—including test scores, answers choices, and reaction time, and location—to deliver individualized playlists of videos and game content on their personal iPods to maximize individual learning (Revelle, 2009).

A pilot project done by teachers in the Escondido Union School District (Group Special Mobile Association, 2012) is another example of using MT to support personalized learning. The teachers implemented iPods to improve English reading comprehension by motivating students to enjoy reading. Students were asked to record and listen to themselves reading a story as an assignment by using the voice memo feature on iPods. Using students recorded audio clips throughout the semester, teachers were able to help students develop their “time-stamped” digital portfolio to track their progress. While developing the portfolios, teachers were able to monitor individual progress and give direct feedback to each student to improve reading skills. Also,
teachers reported that while recording and listening themselves, students were more enjoyed and motivated in learning. The teachers reported that students’ reading fluency “increased at six times the rate considered normal for that period of time” in six weeks. “After 6 months, students gained almost two years of reading comprehension” (Group Special Mobile Association, 2011, p. 14). These positive learning outcomes showed the potential of this project, so the team planned to replicate the project again the following year using iPad.

Above case studies reveal that MT can be used as a personal learning assistant by supporting students’ specific needs and offering personalized learning experiences. Using MT, students can look for information in order to overcome their learning challenges anytime when they need to. Using educational mobile games and apps on their devices, students can anonymously advance their learning depending on their capability. Teachers can easily track students’ progress to provide tailored instruction. However, in order to adopt new MT in curricula effectively and sustain its use, teachers need systematic and quality professional development to develop their technical and pedagogical skills in order to plan their lessons.

2.3.4.1.4 Constructive learning

Lastly, MT encourages creation and exploration in learners and stimulates constructive learning. To fully understand how MT can support student learning, it is necessary to explain the importance of constructive learning. From the constructivist view, education is an active process. According to Dewey (1902), education is a “process of living” (Dewey, 1902/1964, p.430). Thus, students learn best when they explore a
practical issue or a new concept in an authentic context by inquiring and testing the situation. Through this process, students can find their own interests and develop their own skills and talents, which they can then employ in their professional practices (Dewey, 1902/1964; Lave, & Wenger, 1991).

According to Jerome Bruner, who is an advocate of constructivism, learning is more effective when teachers provide learning activities in which students can explore and discover (Bruner, 1996) because in this way, students can actively construct new ideas or concepts based on their previous knowledge to scaffold new knowledge. Also, students can capture both “know what” and “know how” to gain a deeper understanding of both the subject and the process (Brown, Collins, & Duguid, 1989). This constructivist teaching approach enables learners to interact with authentic situations.

Using portable wireless mobile technology, a teacher can promote constructive learning by creating active learning lessons. Using multimedia features, such as microphones and cameras, students can apply what they have learned in the classroom, create their own learning content, and present their understanding of the subject.

Garry Hoban (2009) exemplified this application of MT in a study of pre-service kindergarten teachers implementing smartphones to teach science. One teacher used MT to help students develop their understanding of spider webs. This pre-service teacher first explained how spiders construct their webs; then, the kindergarteners used mobile phone cameras to create an animation to show how spider webs are formed. Kindergarteners drew each sequence of a spider web on a blackboard and took photos of each scene. They uploaded the photos to computers to make animations that represent their understanding.
The teacher reported that while researching and making their own scientific learning content, students worked together to actively construct their own knowledge, which improved their sense of ownership and responsibility in learning. Also, while exploring mobile cameras and video editing software, kindergarteners were able to develop technology and media literacy skills.

A year-long case study, MyArtSpace, is another good example that shows how MT can support outside classroom learning activities and help students create and use their own learning content to achieve their learning objectives (Sharples, Lonsdale, Meek, Rudman, & Vavoula, 2007). The aim of this project was to connect between classroom instruction and a museum field trip using mobile phones as a creative tool. 3000 schools students aged 11-14 and their teachers participated in this project. In the classroom, before the museum trip, teachers prompted students with questions, such as “what was the role of women in the allied landings”, explained learning objectives of their trips, and handed out work sheets. When students arrived at the museum, children were given mobile phones with MyArtSpace software. While students explored the museum, students were able to view the multimedia presentations of exhibits to learn about the projects that they selected and see which exhibits or pieces other students had viewed. Also, students could use mobile phones to make notes, take pictures, and record their voices. When students saved their notes, pictures and voices, MyArtSpace automatically uploaded those to the museum website under each student account. After the trip, students could access their media materials on the museum website to create multimedia PowerPoint presentations to report on their field trips. Students were also allowed to
share their PowerPoint presentations with their classmates or with their teachers. If teachers allowed, the students could share their reports with students and teachers from other schools.

The study reported that students “engaged more with the exhibits than in previous visits and had the chance to do meaningful follow-up” (Sharples, Lonsdale, Meek, Rudman, & Vavoula, 2007, p. 5). The project was able to reduce the gap between classroom instruction and field trip “by enabling student to create artifacts in the museum, and have them readily available for further work in the classroom, and [by] extending the museum context into the classroom through the online museum stores” (Sharples, Lonsdale, Meek, Rudman, & Vavoula, 2007). Also, students said they liked the fact that they used mobile phones, which they are already familiar with, rather than a museum guide handheld device. Students were motivated and spent more time exploring the museum than in previous visits. This positive impact of MyArtSpace shows that MT could support the constructivist learning environment by allowing students to create their own learning content. More importantly, MT supports teaching and learning when it is accompanied with classroom teachers’ follow-up instruction.

Overall, both studies, pre-service in Hoban’s study and MyArtSpace reported that students were very engaged and enjoyed learning more while creating their own learning content. The case studies above show that MT can be used as a creative tool to leverage the constructive learning approach by enabling teachers to integrate active learning activities.
This brief review has shown the educational potential of MT based on students' and teachers' experiences. This section has presented four educational benefits of MT: "anytime, anywhere", collaborative, individual, and constructive learning. It is important to note here that MT is still developing, both as a technology and in relation to education; therefore, the benefits identified above remain tentative and further research is still needed.

2.3.4.2 Challenges

Along with educational benefits discussed above, research has also reported a number of trade-offs and challenges: accessing inappropriate information (Goad, 2012; UNESCO, 2011), classroom distraction (Campbell, 2006; End, Worthman, Mathews, & Wetterau, 2009; Gingerich, 2011), cost of equipping quality MT and its service (Attewell, 2005; Herrington, 2009; Kukulska, 2010; UNESCO, 2011), lack of professional development (Naismith, Lonsdale, Vavoula, & Sharples, 2004; Shuler, 2009; UNESCO, 2011; Ferry, 2009), dangerous behaviors (Pew Research Center, 2009; Thomas & Bolton, 2012; UNESCO, 2011; Willard, 2011), as well as creating a new form of discrimination (Goad, 2012). These drawbacks are crucial factors that discourage teachers from using MT in their instruction.

First, MT can interrupt student learning. MT enables students to access recent web resources anywhere and anytime; however, this advantage worries teachers because students may find incorrect information and develop inappropriate knowledge (Goad, 2012). Also, classroom distraction is another challenge that teachers found. Teachers argue that student use of mobile phones not related to classroom activities, such as
texting their friends, causes difficulty focusing on classroom lessons and consequently risks poor learning outcomes (Campbell, 2006; End, Worthman, Mathews, & Wetterau, 2009). A recent research finding supports the teachers’ opinions. Amanda C. Gingerich (2011) examined the impact of texting on students’ comprehension of lectures. The research found that students who received text messages during the lecture performed worse on their quizzes than students who did not receive any text messages (Gingerich, 2011).

Even more worrying, MT can also create interruptions that can seriously harm learners, such as sexting. According to Pew Research Center (2009), 4% of students ages 12-17 reported that they had sent sexual images or videos of themselves to someone via text message (p.5). Fifteen percent said that they had received sexual images of someone they know via text message (p.5). Nancy Willard, an expert in cyber-bullying, reports that cyber-bullying and sexting can occur in the classroom when MT is not forbidden (Willard, 2011). For these reasons, teachers hesitate to adapt MT in the classroom (Goad, 2012; Thomas & Bolton, 2012).

Second, educators worry about the cost to implement MT in the classroom. The cost of mobile devices has declined while the number of mobile users has grown. However, wireless network infrastructure has not kept up with the advancement of mobile technology (Herrington, 2009, p. 61). Specifically, at the institutional level, installing the Internet infrastructure and expanding bandwidth to provide wireless network services are still expensive (Attewell, 2005, p. 16). As technology develops, MT has gained more computational capability while types of MT are becoming more diverse.
Also, teachers reported that mobile technologies were more useful when they were paired with other software and hardware devices, such as video editing software, headsets, and microphones (Herrington, 2009; UNESCO, 2011, p. 12); however, hardware and software developments do not yet allow the diverse types of MT to communicate cheaply and efficiently. These mobile accessories are extra costs that stakeholders need to consider.

Third, the variety of mobile phones is another difficulty when integrating the devices into the classroom. Each phone has different capabilities. Some phones are simple, while others are far more advanced (Goad, 2012; Herrington, 2009). Thus, teachers may be unsure how to run the same educational activities for all learners because of the variation students may experience due to device differences. Additionally, MT has created a new version of socioeconomic discrimination. Teachers worry about hurting students’ feelings by revealing phone models as symbols of wealth: “those that do not have the latest phones may be embarrassed, and do not wish to be identified” (Goad, 2012, p. 100).

Lastly, a lack of teacher professional development programs is another drawback that educators discuss. Technologies can support teachers and students, only if teachers know “when, why and how to use these tools” (Ferry, 2009, p. 45). As with previous technologies, most mobile learning technology implementation did not include quality professional development, so “teachers did not know how to use [MT] and as a result [MT] did not promote learning; instead it became a source of distraction” (UNESCO, 2011, p. 16). To improve teachers’ capabilities to use mobile technologies, stakeholders
should provide professional development that improves both technological and pedagogical skills and knowledge (Goad, 2012; Naismith, Lonsdale, Vavoula, & Sharples, 2004; Shuler, 2009; UNESCO, 2011).

2.3.4.3 Suggestions for future study

Unlike wired technologies, such as TV and desktop computers, mobile learning technology shows greater potential in changing teachers’ and students’ patterns of practices. MT provides educators with new ways to generate, share, and distribute instructional content while stimulating students’ participation; therefore, educators considered it a valuable tool to enhance the quality of education. However, educators also reported some challenges to implement MT in learning and teaching. To reduce the drawbacks and maximize the benefits, research suggests that educational leaders should put top priority on motivating (Mifsud, 2002) and preparing teachers (Goad, 2012; Naismith, Lonsdale, Vavoula, & Sharples, 2004; Shuler, 2009; UNESCO, 2011).

There is not yet research that I am aware of at this time that actually investigates skills and knowledge teachers should acquire and improve in professional development. Thus, I suggest that to develop effective programs, more scientific research is needed to determine the content, in other words the skills and knowledge, of future MT training programs for teachers. To understand a theoretical framework for the teacher knowledge required for effective technology integration, the next section discusses Technological Pedagogical Content Knowledge (TPACK), which describes specific knowledge types teachers need to have to effectively integrate technology into the teaching practice.
2.4 Teacher Skills and Knowledge to Integrate Technology (TPACK)

This section discusses Technological Pedagogical Content knowledge (TPACK), a theoretical framework that describes teachers’ essential knowledge for technology integration in curriculum. To understand TPACK, this section illustrates (1) the importance of technological knowledge and (2) examines the concept of each component of TPACK.

2.4.1 The importance of technological knowledge (TK)

Teaching is a complex activity that requires different kinds of knowledge. Teachers need to know the subject matter, how students learn, and how to manage students’ learning activities (Spiro, 1988; Leinhardt & Greeno, 1986). Along with this pedagogical knowledge (PK) and content knowledge (CK), teachers’ technological knowledge (TK) has become significant in modern era due to the development of technology (Mishra & Koehler, 2006; International Society for Technology in Education (ISTE), 2008; Graham, Burgoyne, Cantrell, Smith, St Clair, & Harris, 2009).

There are two reasons why TK has become more important for teachers. First, the complexity and diverse properties of modern technology make it difficult for teachers to apply technology in “straightforward ways” in teaching and learning (Mishra & Koehler, 2007, p.2). Traditional educational technology, such as pencils and chalkboards, is simple to use and has a clear function in instruction. For example, the function of a pencil is for writing. It is easy to learn how to use and has not changed its form and functionality over time. Unlike this specified and stabilized traditional educational technology, modern technology, such as desktop computers and mobile devices, are “protean (useable in
many different ways), unstable (rapidly changing), and opaque (the inner-workings are hidden from users)” (p. 2).

Second, providing quality professional development and preparing teachers with adequate technological knowledge has become crucial in the 21st century to keep up-to-date with the changing technology and enabling teachers to successfully integrate emerging technology in curricula. The digital literacy skills have become crucial to prepare our students for their future careers. This phenomenon requires teachers to teach subject matter with advanced technology in order to improve students both subject matter knowledge and digital literacy skills—ability to identify and use technology efficiently as a tool to research, organize, evaluate, and create, and communicate information—to prepare students to become digital citizen (Jenkins, 2009; New Media Consortium, 2005; Partnership for 21st century skills, 2003). Since 1980s, the need to use technology in the classroom has become “the forefront of educational discourse” and imperative (Mishra & Koehler, 2006, p. 1023).

Unfortunately, the earlier teacher training focuses on how to operate diverse tools rather than focusing on why and how to utilize those tools to enhance student learning. By viewing TK as a separate domain from the pedagogical content knowledge (PCK), TK was “nonexistent or considered to be relatively trivial to acquire and implement” (Mishra & Koehler, 2006, p. 1025). Technological training was isolated from PCK and focused on skills-based uses of technology. This context-free training did not help teachers learn how to use technology to teach their subject matter and limited its use in

2.4.2 What TPACK is

To improve quality of teacher training, Mishra and Koehler (2008) proposed TPACK framework that illustrates the important three types of teacher knowledge and their interactions to integrate technology in teaching. TPACK is building upon the pre-existing PCK framework by adding technology knowledge, developed by Shulman (Figure 1).

![Figure 1: Pedagogical Content Knowledge](image1)

![Figure 2: Technological Pedagogical Content Knowledge and its Elements](image2)
TPACK consists of three fundamental knowledge types and four intersecting domains (Figure 2). The three fundamental types of knowledge are pedagogical knowledge (PK), content knowledge (CK), and technology knowledge (TK). These four-intersecting sources of knowledge are pedagogical technological knowledge (PTK), technological content knowledge (TCK), pedagogical content knowledge (PCK), and technology pedagogical content knowledge (TPACK). To understand the TPACK framework, the remainder sections present each component of TPACK.

2.4.2.1 Content knowledge (CK)

Content Knowledge (CK) is understanding subject matter that needs to be taught (Schmidt, Baran, Mishra, Koehler, & Shin, 2009; Koehler & Mishra, 2009). CK includes facts, theories, and concepts as well as validation procedures that encompass a subject (Shulman, 1986). An example of an art history teacher’s CK is the history of art, names of paintings and artists, as well as movements of art, such as impressionism and cubism.

CK also includes teachers’ understanding of complexity of topics in order to present the content in an appropriate order for students (Koehler & Mishra, 2009). For example, a teacher needs to teach a concrete material first, such as a shape of baseball, before abstract content, such as circle. If teachers do not have appropriate content knowledge that they need to teach their students, teachers can misrepresent the content in an inappropriate order and so students will be unable to make conceptual sense of the subject matter (Ball & McDiarmid, 1989; McDiarmid & Ball, 1989, p. 6). Thus, to instruct content to learners, it requires teachers to have a quality CK.
2.4.2.2 Pedagogical knowledge (PK)

Pedagogical Knowledge (PK) is knowing about teaching methods and principles that enable teachers to utilize pedagogical activities (Koehler & Mishra, 2009). PK includes teachers' understanding on how students attain new skills and knowledge and how students build their behaviors. This knowledge enables teachers to design lesson plans, manage classroom strategies, and develop students’ evaluation. Examples of PK are general effective learning strategies, such as problem-based learning, drill and practice learning, and constructive learning that can apply across disciplines. Applying constructive learning theory advocates teachers to use the active hands-on learning activity, whereas behaviorist learning theory advocates the drill and practice learning activities. Knowing different educational strategies helps teachers produce good teaching by designing meaningful learning activities.

2.4.2.3 Pedagogical content knowledge (PCK)

Pedagogical content knowledge (PCK) is different from just knowing teaching principles or knowing about the subject matter. Rather PCK is understanding an interaction of PK and CK that enable teachers to use proper instructional approaches to teach a specific subject (Koehler & Mishra, 2009; Mishra & Koehler, 2008; Mishra & Koehler, 2006). Thus, teachers with PCK will be able to answer questions about what learning strategies facilitate students to learn a topic to empower the learning process. For example, a science teacher may choose a constructive learning approach to teach the concept of gravity whereas a mathematic teacher may choose the behaviorist learning approach to help students memorize the mathematical symbols and rules. By applying
appropriate instructional strategies to teach a specific content matter, teachers can
effectively formulate and represent a concept to help students gain a better understanding
of the subject and increase their prior knowledge.

2.4.2.4 *Technological knowledge (TK)*

Technological knowledge (TK) is knowing about various educational tools, such as books and pencils, as well as more advanced digital ones, such as computers and mobile devices (Mishra & Koehler, 2006; Mishra & Koehler, 2008; Schmidt, Baran, Mishra, Koehler, & Shin, 2009). TK also involves basic technical literacy skills. For example, to use a computer, teachers need to know how to turn it on and off, navigate the files, and use software, such as web browsers and Microsoft Office.

Along with these basic technical literacy skills, Mishra and Koehler (2006) suggest that TK should also involve teachers’ “ability to learn and adapt to new technologies” (p. 1028). Information technology continuously develops and changes quickly unlike traditional educational technology, so technology that teachers learned in their educational training may not be applicable later in their profession. Thus, building a broad understanding and fluency of information technology is more important to help teachers “apply it productively at work and in their everyday lives, to recognize when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology” (Mishra & Koehler, 2007, p.6). Attaining TK in this manner, teachers can constantly interact with emerging technological tools, readily develop their technological skills, and apply new technological tools in the classroom to support their teaching.
2.4.2.5 Technological content knowledge (TCK)

Technological Content knowledge (TCK) is understanding how to use technology to represent content (Cox & Graham, 2009; Koehler & Mishra, 2009; Mishra & Koehler, 2006). Different technologies have different capabilities and constraints. Knowing the limitations and affordances of different educational tools is important to represent a concept effectively. Thus, teachers who have TCK know “how technology can create new representations for specific content” (Schmidt, Baran, Mishra, Koehler, & Shin, 2009, p. 125). By using this representation that is relevant to function within a specific subject domain, the teachers will be able to facilitate student understanding of the subject matter through technology and able to improve students’ digital literacy (Graham, Burgoyne, Cantrell, Smith, St Clair, & Harris, 2009, p. 74).

An example of the use of TCK is a teacher who implements 3-dimensional interactive simulation to teach a structure of a molecule rather than using two-dimensional pictures and texts. By enabling students to interact and modify the model, the teachers will be able to help students gain a better understanding of the structure rather than learning the structure from two-dimensional pictures and texts. In sum, TCK is another essential knowledge for teachers in order to provide good teaching by selecting suitable technology to support their instruction.

2.4.2.6 Technological pedagogical knowledge (TPK)

While TCK describes the teacher understanding of using technology represent diverse subjects, technological pedagogical knowledge (TPK) describes teacher understanding of the interaction between the use of technological tools and pedagogies
(Cox & Graham, 2009; Koehler & Mishra, 2009; Schmidt, Baran, Mishra, Koehler, & Shin, 2009). Thus, teachers with TPK will be able to select a tool that can support their instructional strategies to facilitate their teaching process. For example, a teacher with TPK will know how to use technology to improve interactivity (Graham, Burgoyne, Cantrell, Smith, St Clair, & Harris, 2009, p. 72). A teacher who believes the efficacy of constructive learning approach will implement an interactive tool that can support students’ active hands-on learning activities rather than a passive educational tool. A teacher who advocates the efficacy of behavior learning approach will select a tool that can provide a drill and practice learning activity. Knowing the interrelationship between the educational affordances and constrains of different technological tools and instructional strategies, teachers will be able to know how to use technology to support teaching and use it to engage students in learning.

2.4.2.7 Technological pedagogical content knowledge (TPACK)

Lastly, technological pedagogical content knowledge (TPACK) is understanding the negation among PK, CK, and TK to produce good teaching. Teachers with TPACK know “how technological tools transform pedagogical strategies and content representations for teaching a particular topics and how technological tools and representations impact a student’s understanding of these topics” (Graham, Burgoyne, Cantrell, Smith, St Clair, & Harris, 2009, p. 71). Thus, they are able to coordinate effective learning activities by selecting appropriate technological tools that can represent a specific concept effectively and that can support a specific instructional strategy to facilitate student learning (Koehler & Mishra, 2009; Schmidt, Baran, Mishra, Koehler, &
Shin, 2009; Mishra & Koehler, 2006). For example, an art history teacher with TPACK will know the list of available resources and tools to represent history of art, such as Microsoft offices, books, art dictionaries, and museum websites (TCK). The teacher will know which resources and tools are useful to prepare an informative lecture to transfer information (TPK). Along with these general applications of three types of knowledge, the art teacher will also know which tools that they want to use to teach a specific concept, for example an impressionism, by using a specific learning approach, such as a constructive learning approach (TPACK).

Based on the understanding of the transactional relationships among these three types of knowledge, teachers can effectively use technology to compensate the presentation of content and to open up new teaching and learning possibilities to flourish their instructions with technology.

2.4.2.8 Summary

The TPACK was developed by Mishra and Koelher (2008) to describe how technological, pedagogical, and content knowledge interact with one another to produce good teaching with technology. TPACK is required knowledge for effective technology integration. Although each element of TPACK framework is important for good teaching, this study focuses on examining its four parts that are related to the use of technology, TK, TPK, TCK, and TPCK.
CHAPTER 3

3 Method

3.1 Research Questions

This study investigated the perspectives of teachers who used iPads in their classrooms at least one year. The overarching research question was: which factors, related to knowledge, skills, and motivation do teachers report as influential when using MT, specifically iPads, for educational purposes? The questions that guided this study were as follows:

- What components of knowledge do teachers think they need to use iPads?
- What skills do teachers think they need to use iPads?
- What motivates teachers to integrate iPads in the classroom?

3.2 Research Design and Strategy

This study is based on multiple qualitative case studies. I have chosen this qualitative research method to gain a valuable, deep understanding of teachers' self-perceived needs. Among the available qualitative strategies, I have chosen a case study approach. Case study strategy consists of a detailed investigation of data in a context. Thus, this research strategy increases a researcher's understanding of "how behaviors and processes are influenced by, and influence context" (Hartley, 2004, p. 323).

Using the case study approach, I was able to interview teachers from different subject areas in depth to understand factors related to knowledge, skills, and motivation, which impact their use of iPads for educational purposes. I gained an understanding of
the reality of participants and made an informed contrast within those cases. To determine teachers' self-perceived skills and knowledge to use iPads, I asked their experiences in using iPads in teaching. For example, instead of asking, "Do you use X app to create a collaborative learning environment?", I asked "What Apps do you use? Why did you decide to use them in your teaching?" By examining their experience and reasons for using iPads, I was able to determine teacher self-perceived knowledge and skills, and minimized imposing this researchers perspective while collecting data. To determine their motivation, I asked teachers' reasons for using iPads in teaching. This interaction enabled me to gain a deep understanding of knowledge, skills, and motivation required to use iPads from teacher perspectives.

3.3 Participants

To find the target participants experienced in using iPads in instruction, I used a combination of purposive and criterion sampling. The first requirement of participants was that teachers had used iPads for at least one year for instruction. My assumption was that teachers who used iPads for educational purpose would have a deeper insight on the benefits and challenges of using iPads. These experienced teachers would be able to suggest knowledge that novice teachers need to integrate iPads. These participants would be able to explain the challenges and make useful suggestions to integrate iPads based on their experiences. Also, they would be able to explain which factors have encouraged them to use iPads in the classroom.

The second requirement of my participants was that they teach in Massachusetts public schools as a matter of convenience in terms of access. The case study approach
requires a researcher to interact with and examine organizations for weeks to collect
detailed information (Hartley, 2004). Therefore, to sufficiently observe my participants to
collect rich information, I chose schools in Massachusetts.

I was able to find participants through two educational technology specialists' help, David Whittier, a professor of the Educational Media and Technology program at Boston University (BU), and Dr. Domenic Screnci, the Executive Director of the Educational Media and Technology Center at BU. Professor Whittier introduced me to an educational technologist, Mr. M, in a middle school. Dr. Domenic Screnci introduced me to an educational technologist at Boston University who ultimately led me to a teacher, Mr. H, at a high school. With Mr. M's and Mr. H's help, I was able to gain permission from principals and superintendents to recruit participants in their staff meetings.

In staff meetings, I presented my study purpose, methods, duration, and criteria of potential participants. During the meetings, sign sheets were passed out to collect their names and preferred contact information.

Initially there was a total of 19 participants: 17 teachers and 2 educational technologists (Table 2). While scheduling the first interviews, three teachers requested to be dropped from the study due to their busy schedules. In addition, I reluctantly had to drop three more teachers: two Art & Technology teachers. I dropped the two Art & Technology teachers because of their particular subject content and additional teaching tools. They required other technologies to teach their subject, such as sensors, motors, actuators to build robots. As a result, the total participant was reduced to 14: 12 teachers and 2 educational technologists.
To request interviews, I sent e-mails to share a public Google spread sheet where participants could see appointment availability. The participants were able to select a meeting time and a location at their convenience. I used this public schedule sheet to avoid scheduling conflicts.

3.4 Participants' Background

There were a total of 12 teachers in 5 different subject areas who participated in this study: three English teachers, one mathematics teacher, four science teachers, two special education teachers and two social studies teachers. All teachers have taught in Massachusetts for a minimum of 9 years.

All middle and high school participants had already used iPads for over one year. There were one or two subject teachers from each one of middle and high schools. Thus, to reduce revealing my participant identities, I only share each teacher's information that is necessary for this study, and discard grade information. The participants' background information is described in the Table 3.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Subject</th>
<th>Middle School</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>English</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Social Study</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Special Education</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Educational Technologist</td>
<td>N/A</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: Number of Participants
3.5 Data Collection

To triangulate data, I collected three types of data: interviews, classroom observation, and classroom documents. First, I conducted in-depth, semi-structured one-on-one interviews with each teacher to explicitly investigate each teacher’s expertise, specifically focused on knowledge, skills, and motivation related to the use of iPads for education. I chose this semi-structured interview, with pre-specified questions, to ensure consistency in the content of the questions asked and to ensure key questions were not overlooked.

Second, I used classroom observation. Observing participants’ classrooms allowed me to gain a better understanding of the classroom environments, infrastructure, and to validate teachers’ opinions. To collect and organize data systematically, I used a data gathering form included participant name, gender, an observation date, subject matter, and a classroom location that helped me uniquely organize each event’s data.

Also, I included two columns to record key information, one for the source of each key

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>Subject</th>
<th>Teaching Experience</th>
<th>iPads Experience in Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>BME</td>
<td>English</td>
<td>9 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>OME</td>
<td>English</td>
<td>17 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>AHE</td>
<td>English</td>
<td>14 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>BHM</td>
<td>Mathematics</td>
<td>17 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>MMS</td>
<td>Science</td>
<td>12 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>KMS</td>
<td>Science</td>
<td>9 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>THS</td>
<td>Science</td>
<td>31 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>WHS</td>
<td>Science</td>
<td>18 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>PHS</td>
<td>Special Ed</td>
<td>14 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>LHS</td>
<td>Special Ed</td>
<td>29 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>BMS</td>
<td>Social Study</td>
<td>14 years</td>
<td>Over 1 year</td>
</tr>
<tr>
<td>BHS</td>
<td>Social Study</td>
<td>12 years</td>
<td>Over 1 year</td>
</tr>
</tbody>
</table>

Table 3: Teaching Experience of Participants
piece of information with my observation of that event, and one for any questions that arose while examining the event. In this way, I was able to ask detailed questions without interrupting classroom activities.

Third, I also conducted follow-up interviews and collected classroom documents to examine teachers’ implicit use of iPads. Documents, such as lesson plans, syllabi, and students' projects, enabled me to understand how participants had used iPads in curricula that I could not discover through my direct observation. Using these multiple resources in an investigation of using iPads enabled me to triangulate data and thereby improved the validity of the information.

Fourth, I also interviewed one educational technologist from each school. The aim of this study is to examine teacher self-reported needs to use iPads in teaching. However, the communication with educational technologists was necessary just to confirm the consistency of interview data and to add validity of this study.

3.6 Conducting Interviews

Participants were asked to read an informed consent form before the interview, so they were aware of their rights and the purpose of this research. I also informed my participants that I would request a second meeting for follow-up interviews.

Based on the literature review and the subsequent research questions, I developed an interview protocol to target teachers’ self-reported understanding of knowledge, skills, and motivation to use iPads for educational purposes. The initial interviews started with open-ended questions, for example "What is your experience in using iPads for instructional purposes?" and follow-up questions were based on the interviewees’
answers, following the interview protocol, included in Appendix A. The follow-up interviews were conducted after 2 classroom observations; follow-up interviews are discussed in detail in 3.7.

Both first and second interviews were audio taped. I wrote down notes during the interviews to precisely understand and interpret the interviewees' opinions. Any identifying information in the audio was not transcribed and my interviewees’ names were coded, such as BHM, PHS, and etc. The informed-consent form is included in Appendix B.

3.7 Data Analysis

I had three data analysis phases, (1) first interview and classroom observations, (2) follow-up interviews and classroom documents, and (3) coding and developing themes.

In the first phase, I completed the first interviews and observed each classroom twice. The audio-taped interviews were transcribed using the software Express Scribe. I transcribed all the first interviews to familiarize myself with the data and to protect my participants’ identification. Since English is my second language, I hired an English native speaker to confirm the accuracy of my transcriptions. I read over the transcriptions and the classroom observation notes carefully to write a short summary of data, to notice unclear data, and to prepare the second interviews. After I fully understood the data, I re-contacted the teachers to schedule the follow-up interviews.

In the second phase, I conducted the follow-up interviews and collected classroom documents to triangulate different sources of data. I requested teachers to share classroom
documents or student projects that they had mentioned in the first interviews. To transcribe the second interviews, I decided to hire transcribers to get quality and accurate data quickly. Transcribing the first interviews took me excessive time. In addition, I needed to hire English native speakers to check the accuracy of the interview data that cost me extra time and money. So I decided to use Amazon Mechanical Turk (www.mturk.com) to hire transcribers.

In the third phase, I coded the first and second interview data and field notes by using NVivo, a qualitative research software. During the coding process, I was able to categorize the large amounts of text data around my research questions and discover themes. Also, using NVivo, I was able to query specific codes and visualize the relationships among those codes. Those visualizations gave me an overview of the relationships of the data and helped me observe the association among the themes. By continuously reviewing, synthesizing and coding the data, I was able to find conceptual connections between the data to interpret the meaning of the information from the perspective of the participants.
CHAPTER 4

4 Results

4.1 Introduction

This study aimed to report teacher self-perceived needs for using MT, in terms of knowledge, skills, and motivation. Specifically, this study was designed to answer the following questions:

- What components of knowledge do teachers think they need to use iPads?
- What skills do teachers think they need to use iPads?
- What motivates teachers to integrate iPads in the classroom?

The data to answer these research questions is drawn primarily from the interviews. To triangulate the data, I also collected classroom documents and conducted classroom observations; knowledge gained from the observation and document analysis was used to supplement or explain data culled from the interviews. For example, teacher content knowledge was expected based on the Massachusetts teacher licensure requirements and this researcher’s classroom observations rather than through interviews. Motivation is a person’s internal process that influences human behavior. Thus, classroom materials analysis did not provide any further understanding to illustrate teacher motivation, and so I focused on evidence of motivation through interviews.

The purpose of this study was to examine teacher self-reported perceptions of their knowledge, skills, and motivation to use iPads for educational purposes. In analyzing the data, a significant trend was identified: while asked questions to target a
skill, specific knowledge or a specific motivation, teachers discussed these as intertwined rather than individual elements. When teachers discussed their process for iPad integration, they tended to focus, largely in this order, on their goals, problems, and benefits of available resources, including traditional and MT resources, and the related strategies, implementation and motivations, which reveals elements of knowledge, skills, and motivations these teachers experience as significant in the process of iPad integration. Because teachers generally did not discuss knowledge, skills, and motivation as discrete elements, the data suggest these are "intertwined", meaning each element is discrete but generally works with or combines with others to serve the education goals - teaching and learning.

When considering organization of the findings, an issue arose which required balancing the a priori research questions and the themes revealed by the data. Despite the experiences of "intertwined" knowledge, skills, and motivation, I was able to identify discrete elements. Therefore, in Chapter 4, data are organized around the fundamental research questions, with each broad section, knowledge, skill, and motivation, divided into sub-themes.

That said, because this "intertwined" development was pervasive in the data, in Chapter 5, the findings are presented through the major themes and sub-themes that emerged rather than in response to the research questions. In this way, the final discussion demonstrates how teachers experience their own knowledge, skills, and motivation to allow for further suggestions specifically tailored to suit teacher experiences and perceptions.
4.2 Teacher Knowledge to Integrate iPads Through Curriculum

4.2.1 Content knowledge

Obtaining participants’ content knowledge through interviews was challenging, because asking professional and state licensed teachers about their understanding of content was unsuitable and disrespectful to the participants. Thus, this study estimates teacher content knowledge based on the Massachusetts teacher licensed regulations and my classroom observations.

4.2.1.1 Massachusetts teacher licensed regulation

All participants were state licensed teachers and taught in the Massachusetts public schools for a minimum of 9 years (See 3.4). According to Massachusetts law, public school teachers are required to obtain a license, issued by the Massachusetts Department of Elementary and Secondary Education (DESE). An “initial” license, a teacher is required to complete a Bachelor’s Degree educator preparation program. Teachers also have to renew their licenses every five years by demonstrating proficiency in their relevant subject areas. Detailed teacher recertification regulations can be found on the website, http://www.doe.mass.edu/lawsregs/603cmr44.html. Thus, based on the regulations for teacher licensure in Massachusetts, participants’ content knowledge was accepted for the purposes of this research.

4.2.1.2 Classroom observation and resources

Along with the Massachusetts teacher licensure law, I witnessed each participant’s knowledge of the facts, concepts, theories, and principles related to their subjects during the classroom observations. One specific example that reflected this
content knowledge was inquiry-based learning activities. When students asked questions, teachers encouraged students to search for online information using student iPads to answer their own questions, for example by commenting “Oh. that’s a really good question. All right! Everybody search and see what answer you find and then we’ll share and we’ll talk about it.” By requiring students to search, synthesize, and present their understanding to the classroom, teachers were able to (1) check the accuracy of the information that students found, and (2) guide further discussion of the topics that students were curious about, demonstrating their command of the content knowledge. It was obvious from observing such interaction that all participants had sufficient content knowledge of their subject matter.

4.2.2 Pedagogical knowledge

Analysis resulted in defining four sub-themes related to pedagogical knowledge: understanding of instructional goals, understanding of learners, and understanding of major aspects of technology integration as trial and error. This section details participants’ self-reported pedagogical knowledge based on interview data, classroom observation notes, and materials analysis. The interview data is presented in bold because it was that is more salient to the findings.

4.2.2.1 Understanding of instructional goals

All teachers emphasized that understanding of their own instructional goals—

*deepening understanding, designing effective learning environments like constructive*
learning, and developing independent learners—was the initial step to integrate iPads in teaching. The following four teacher discussions illustrate this finding.

THS: For me it was at the end of the unit what do I want the students to be able to do? And then I worked backwards from that to try and figure out where it was best to put the iPad in and some of the stuff just merely comes to you.

MMS: I think when people start getting anxious about using the iPad, they think that they have to completely re-design the wheel. You don't have to re-design the wheel. What you need to do is find out what your lesson goals are, how the iPad melts into your current lesson. Like, you find out how can you use the iPad to make your lesson better. I still don't use the iPad every day because it doesn't always lend itself to the activity that we are doing. But, if you CAN use it, and you can make learning better, that's when you integrate the iPad.

BME: We had the idea; have them read articles. Then, we thought, 'Okay, why don't we have them reading different articles. Then, they'll have something to present. How could they do that? Oh, well, if we want them to share it and present it, we should have the use the iPad for that.' So, I think it was kind of a logical (process). What's our goal; what we have in mind is for them to compare and contrast these articles. How are we going to get them to do that? We're going to use the iPad.

AME: As a teacher, you always think about what your end goal is, and you're asking yourself, "all right, if this is my goal." I think it's really important to have your goal and objective in mind, and not just use it because it's a "fun tool" to use. I don't think most people are going to do that, but ultimately, it's gotta be for "why am I doing this". And, if it's not meeting a goal that I have, then why would I be doing it? So, I think it's really important to keep asking yourself, "What's the goal?", "What's the objective?", "Will this help me reach that?" And, if so, then let's use it.

Together THS, MMS, BME, and AME demonstrated the importance of setting instructional goals to initiate the integration of the iPad in teaching. It was never the case teachers reported using iPads as instructional goals.
Participants further reported three specific instructional goals related to their integration of iPads.

4.2.2.1.1 Goal 1: Deepening learner knowledge

One reported goal was to deepen student understanding of the content by utilizing both traditional and supplementary teaching resources. Teachers expected students to conveniently access diverse supplementary online resources, in/outside of the classroom to study the materials to better understand content.

One specifically illustrative example of this is BHS, who had created an iTunesU course that divided his course into topics. Under each topic, he shared his diverse teaching resources, such as an e-textbook, worksheets, and extra online resources, such as YouTube videos. BHS aimed to aid the learning process and deepen students’ understanding of target content through those resources rather than what he perceived to be the more limited information delivered in the required textbook.

BHS: I usually go deep on topics that I think the book doesn’t go onto enough topic and detail about. So what they will do is, they will come to this [iTunes course], they can watch the video on their own even at home because they obviously all have the iPad. To make them actually read it, what I do is, for every chapter, I create questions to go with the book. So these questions...Go right along with that material that I created. So that way I know they are actually doing it.

This integrated goal was witnessed during a classroom observation. During the lesson, students took turns reading aloud from the textbook. Then, using the online course content via individual iPads, students viewed a newsreel of the target content on YouTube.

To complete the lesson activity, students were grouped and then asked to
download the appropriate question sheet for the lesson. Students were encouraged to discuss questions in their groups, use the textbook, and access online sources in the course lesson folder along with external web links. However, they were required to individually answer all lesson review questions electronically.

In the follow-up interview, BHS further discussed his instructional goal to achieve deeper student understanding by supplementing with diverse teaching resources.

BHS: It's [iPad access] allowed me to go into more detail without buying more textbooks. I can't buy things on every subject but with this I can just get sources from around the Internet and go into more detail whether it's text, whether it's video, whether it's picture. So I can go into more detail and so I can go over it at their own speed or they can go over it on their own time.

Interview data, classroom observations and class materials together demonstrated that BHS’s pedagogical knowledge includes explicit awareness of a specific goal, which the integration of iPads in teaching helped to achieve.

This goal to supplement teaching with extra resources is not unique to BHS. BHM specifically discussed the increased depth and breadth of knowledge available in e-books vs. print books.

BHM: The biggest thing I like about it [iPad] is the online textbook and the resources because there's so much more on there. Looking at student's edition Algebra I. They have all that kind of stuff. There are student resources on there, so I can actually have them go and they've got videos. There's so much that comes with the book to supplement the instruction that it's all right here. You don't really have to go online and look for your own videos. They have it. It's all mapped to the Common Core Standards and everything. It's self-doing. So, textbook app is probably one of the big things for me.

Adding to the goal of deepening learner understanding through resources, PHS practiced two specific strategies to benefit students learning: (1) keeping students interested and (2)
teaching subjects with real world applications.

PHS: *Math with perseverance is a tough part. A lot of kids don't like to work through to get the problem in a math problem. They don't like to put the time in to do it. A lot of my students will just leave it blank if it's a time consuming thing. So I used it as a method of teaching perseverance, like how, 'I give you a question, now go find the answer.' So sometimes like in class we're doing fractions, decimals, and percentages. I will say, 'Okay, we're doing greatest common factor. You've got two minutes. *Find me real world applications of greatest common factor.*' They take out their iPad, [to search for] greatest common factor and they look for ways in the real world and then we exchange those ideas. So the kids are getting more meaningful experiences. Instead of just like, rote memorization and just regurgitation of facts, there is an actual piece there, or I can present more complex questions to them. And they have the means in which to find information besides their own head. Because that—quite frankly—is not always going to be sufficient.

PHS used iPads to ask students to research online resources, to translate the information into a form that is understandable to them, and share their understanding with classmates.

By guiding students to find, synthesize and present information on their own, the aim is not only to expand student understanding of the content using supplementary resources, but also to provide a constructive learning environment, which is the next instructional goal.

4.2.2.1.2 Goal 2: Creating constructive learning environment

Most participants reported the use of iPads to create constructive learning environment as another goal. In this environment, students engage in activities through which they gain new knowledge and develop skills. Teachers perceived learning to be more fun and meaningful for students, that is new content knowledge is better constructed, through active learning process. For example, one teacher explained the usefulness of iPads to apply this instructional goal in his teaching.
KMS: *One of my goals is implementing more active learning.* Having the iPad, that helps out a lot. So I want the students also to get used to hearing lectures. I try not to lecture REALLY more than once a week. Sometimes, you know, it could be twice a week. That's pretty much the MAXIMUM that I will lecture in a week. And other days it could be active learning. It could be things like doing a lab and developing projects, based on what we talked about previous day, I might have them make posters using Keynote or Popplet type of thing.

During a classroom visit, I observed how KMS used iPads to achieve this goal. The class agenda was creating a “Bacteria Most Wanted Poster,” with a picture of a bacterium and one paragraph of its description. To develop their posters, students first needed to search and select a bacterium that they want to study by using their iPads. Students were allowed to work as a group to discuss their ideas, but were require to develop and submit their own Bacteria Most Wanted posters.

Students were very excited to search, select, and study self-selected bacteria and were motivated to develop their posters. The students’ enjoyment and excitement were clearly explained through their emotional reactions: “Look at this, look at all this information. Mr. KMS, mine is best, I want to make it [my poster] authentic.” When the bell rang at the ends of class, a student expressed his disappointment, saying “Science is done, awwww” and did not want to leave the classroom.

All together, interview data, classroom observation notes, and student projects (figure 3) demonstrated how KMS integrated the use of iPads to achieve the goal of creating a constructive learning environment.
Leprosy, also known as Hansen's Disease, is a chronic infection caused by the bacteria *Mycobacterium leprae* (M. Leprae). These bacteria are prokaryotes, unicellular, and heterotrophs.

- Although scientists are unsure of exactly how leprosy spreads, there are hypotheses that it can spread to nasal droplets and also in armadillos.
- *M. Leprae* infects humans but can be carried by armadillos.
- Skin lesions are one of the primary external symptoms. When untreated it can cause permanent damage to skin, nerves, limbs, and ears.
- Between 2 and 5 million people were affected by *M. Leprae* before 1995. Since then, over 1 billion people have been cured.
- Leprosy can have very severe effects on limbs, the tissue may cause fingers to shrink. The chance are they would be 2 out of 10.
- Dapsone, Rifampicin, & Dihydro急速 are two treatments for leprosy.

**Figure 3:** One Student's “Bacteria Most Wanted” Poster

Other teachers also provided specific examples how they integrated iPads to benefit students learning. Teachers reported that by actively involving students in researching and encouraging them to create projects to form their understanding, students were able to construct their knowledge efficiently.

MMS: *We did this activity, called Genetic Disorders. So the kids have to pick a genetic disorder, and create a research poster on Pages based on the genetic disorder that they find out about it. They need to add different images, and at the bottom, they insert a video file of a personal story. And so, it is really cool because they're using Page, they have images, they have personal stories, they're really seeing someone's face with genetic disorder. Kids are really, really reflective, very serious about it. They realized, you know, just how big some of these genetic disorders are. So that's a huge one that I love. Some of them we put it on the board, and kids like to share, because it's personal experience.*
Overall, teachers reported that their aim of encouraging students to use iPads to create their own projects was not only to create constructive learning environment, but also to be able to take ownership of the learning process and increase their self-directed independent learning skills, which is the next instructional goal.

4.2.2.1.3 Goal 3: Developing independent learners

Some teachers also reported their use of iPads to develop student independent learning skill. They explained that while encouraging students to search and select preferred learning tools, for example iPad apps, and guiding them to discover own learning style, teachers wanted students to practice taking responsibility for learning to become autonomous learners. In this self-directed learning environment, teachers were able to act as a facilitator and develop student problem-solving skills. One illustrative example of these teachers’ perspective is BMS.

BMS: I’ll say [to students] ‘You need to get this piece of information to here. How are you going to do it? It’s okay if you approach things from a different direction than somebody else because you’re just trying to get to this final goal. That’s where the iPad comes in because it allows you to use the different apps on here to get out the product’ Before it was just, here’s the textbook, answer the questions and then move on. Now I let them solve problems using iPads. I’m there as a support and a
cheerleader and connecting them with other people that could help them. I don’t know I just feel like that became different. I was teaching them something I hadn’t taught them before. That was something I found very cool. I get excited about seeing them learn a new skill. For me, it’s not just about teaching them the content. It’s teaching them to become more…learning how to advocate for themselves appropriately and learning how to be individual learners. It’s not just about them knowing where everything is geographically in the world but what are they going to do with that information?

BMS gave another example of how she developed student independent learning skill using iPads. By discussing the differences between traditional and new tools in the classroom, such as iBooks and traditional textbook, with students, BMS aimed to develop students’ analytical skill in selecting appropriate learning tools that helped them drive their own learning.

BMS: I really enjoyed having the students talk about the textbook, the parts of the textbooks and then compare. They saw the hard copy and then they saw what was on the iPad and I talked about ‘What can you get from this one that you can’t get from this one?’ I thought that it was really exciting to have them see that here’s this textbook and just because something goes an iPad doesn’t necessarily make it better.

With the integration of the iPad into her classroom, BMS was able to create “exciting” student-controlled learning. This goal was not unique to BMS. Other participants also reported how they used iPads to give options for students to explore diverse apps and enable to select tools that matched their learning strengths and preferences.

PHS: You’ll [you in the general sense of learners] learn a lot about what type of student you are and how you learn best and seeing the different apps or different ways of studying, they may say, “If I’m going to study that type of material, this iPad would be good but if I’m going to study this, I may need to write it by hand or I may just talk about it.” Right? So it just gives them options.

WHS: I’m getting [students] to think out of box, how would they use the tool. Because isn’t that what we want them to do? We don’t want them to
be told what to do all the time. You want students to have independent thinking skills about how to use a tool and apply it to a new and different situation. So I ask them [students] and then I'll say, here's what we'll do. What ways can we use it [iPad App] and brainstorm.

Overall, teachers reported developing independent learning skills in their students as another goal. This goal led teachers to determine how to use iPads to develop students problem solving skills and independent thinking skill, helping them integrate iPad to support their teaching.

Through synthesis of teacher self-reported experiences and understanding, one overarching theme was identified: the integration of iPads for learning requires first the understanding of educational goals. To achieve this goal, teachers identified three sub-themes as methods for achieve it: Deepening student knowledge through resources; creating constructive learning environment through project-based learning; and developing independent learners through student-driven learning.

4.2.2.2 Knowledge of learners

All teachers reported that knowledge of learners is an additional element of instructional knowledge. All teachers reported understanding of students as (1) individuals with differences, such as previous knowledge and learning preferences, and (2) digital learners in the 21st century.

4.2.2.2.1 Understanding of learner differences

Teachers reported that they used iPads to aid student different learning needs. For example, KMS’s classroom document and the interview data demonstrated his use of iPads to support student-learning differences. KMS created WebQuest worksheets that
had questions along with different web links under each question. By using diverse multi-
media resources, KMS wanted not only to allow students to advance their learning at
their own pace, but also to support different student learning preferences.

KMS: This [Web Quest] is great when I have to differentiate instructions
to different students. So some students are really hungry like for the
information they want to know more... Using iPads, students can go at
their own pace, look at the pictures and there will be other interactive
things on that website to keep them engaged because a lot of them will
be visual learners.

KMS was not alone in understanding different student learning strength and weaknesses
and using his understanding to integrate iPads. PHS further explained how his
understanding of different student learning needs enabled him to integrate iPads to
benefit student learning.

PHS had a student who was particularly sensitive to noises. He reported that
allowing the student to listen to music using the iPad helped the student overcome a
specific learning challenge.

PHS: This isn't an educational usage but to be honest with you, my
students, to be able to listen to music is such a great use of the iPad for
my students. I'll give you an example. I have a kid who has severe ADHD,
Attention Deficit, if he hears any noise he gets distracted. He can put his
headphones on while he's doing a worksheet and it closes everything out
and it gives his brain something to do while he's doing the work and that's
a kid who if he didn't have that, in a totally, say you tell everyone, "Quiet.
Everybody's doing this worksheet, everyone be quiet." That's impossible
for that student. To being able to listen to music has been... [pause] we've
had a sharp decline in disciplinary infractions since we brought the iPad
in.

Benefitting individual learner needs is not the only knowledge of learners reflected
in teacher self-reported perceptions.
4.2.2.2 Understanding of digital learners in the 21st century

Teachers’ comments and their experiences also demonstrated their understanding of 21st century learners’ characteristics that influenced their perspective on using the iPad in teaching. The most frequent teacher comment observed the benefit that their students were competent in using technology. There were, however, three weaknesses; lack of understanding of the use of technology for education, lack of discipline, and lack of patience.

Teachers reported an understanding of the strength of the 21st century Digital learners: digital competency. Expressing ideas representative of all participants, BME, OME, and AHE discussed this.

BME: *We are in an age where, this is what students are used to, swiping and looking, having information at their finger-tips. We are probably not going back to the way things were, and I think that this is the age that we’re in. This is how kids are accessing information, and I think it only make sense that we would try to use the technology to work with kids of this age. Because, this is their world now.*

OME: *It's part of their culture, so, I think that they, because they grew up with computers and it's harder for teachers to learn a lot of these new apps and stuff, but these kids, they know how to use the apps and I think it gives them a sense of ownership for a lot of things that they do.*

AHE: *for me, trying to access their culture, which is not mine, and it is kind of foreign to me. It's helpful to figure out, okay, so if this is what you're doing with nine hours of your day – because it's what they're doing with nine hours of their day...So, if I can use the same tool [mobile technology] that they're using and actually teach them something valuable for their education, then I've done my job, because they're learning something that they should be learning using a tool that, perhaps, or a method by which they are used to.*

Teacher participants reported relying on this strength of the 21st century learners, comfort and skill in using technology, such as the iPad, not only as skills students were certain to
have, but also to expand the teachers' own technological knowledge.

WHS: *The kids know the technology and they can get one there. Just, just ask. If they're a good class of kids, a lot of them are pretty smart with the technology and they say “Oh yeah, we could film this, take pictures, we could use it as a collection device. We could,” you know. The kids will come up with stuff. And so a lot of the stuff I've learned, I didn't come up with it, my students did. And I said now when I do it in the next class I say “Get out your iPads and do this” because I learned from somebody else, the students are some of my best resources for getting ideas on how to do something.*

While noting this strength of the 21st century learner, teachers also reported three primary weaknesses: misunderstanding the educational usage of technology, lack of discipline, and lack of patience. This understanding helped participating teachers manage inappropriate use of iPads.

THS and BHS reported that while students do know how to use iPads as an entertainment tool. However, they do not necessarily know how to use iPads in an educational context. Due to the student lack of understanding of educational use of iPads, teachers reported an increased need for instruction on appropriate use of the tool.

THS: *They know how to use it as a social context, but when it comes time for an educational context, I should be the one that knows it better than them. I didn't have a problem with asking them how to use the iPad in general, but they were very unclear as to how to use it, very specifically, for educational purposes...You [teacher] better know what to do and what not to do with this because these kids have it and it's brand new. They know how to use it as a social tool, now we [teachers] have to take and put the socialness away and use it as an application.*

BHS: *Students, yes, and they're comfortable with it, to a certain extent. They know the social media stuff, they don't really know how to work Pages and Keynote, that stuff.*

Related to students' lack of knowledge of iPads as a learning tool, teachers also reported students' lack of discipline in using the tool.
AHE: I would say three quarters of my seniors could handle the responsibility. But you still have that one-quarter that just can't do it. I think for some students, I mean, there are some kids that just can't handle the responsibility of having social media in front of them all day. They just can't.

BHM: That all comes back to maturity. Are they mature enough to say "Oh, that's not the right place, let me get out of here, go someplace else." I mean, that's on them. I think they need to learn that. They need to learn the discipline.

A third weakness teachers reported is a lack of patience, which includes, is due to or is the result of the need for instant gratification and misunderstanding of the effort required in learning.

MMS reported that 21st century students need immediate access to information to keep them engaged in learning new information. MMS discussed an understanding of how to support impatient learners by incorporating the use of iPads.

MMS: Some kid asked today, "What's ring worm?" Instead of running up to my computer and typing it in, then showing them who-knows-what picture, I said, "You have three minutes. Go." He typed it in, and then he got to walk around and showed everybody what it looked like on his iPad. You can finally answer like this, and they enjoy that. Kids need instant gratification. It's the new thing. There's no patience. If you tell them later, they get disappointed. And, no one's excited about the topic. If you can tell them right away, "Oh my gosh, that's so disgusting" "That's gross" "I love that" "That's awesome." They like having it right away.

Self-reported understanding of the need for instant gratification includes not only lack of patience, but also insufficient understanding of the effort required to learn and complete learning tasks. BHS provided a specific of example how he guided his students to put effort while researching and try to remedy this weakness with iPads.
BHS: With the iPad, research is easier with the iPad. I don't know if that's a bad thing, but they can get to Wikipedia easier and I want them not to use Wikipedia as a crutch. I want them to, you know, I, I had to go to a library to research things. I wish they would go to a library and research and not rely on Google... if I do research paper I will say, you need to have three resources. Only one of them can be a website. The other two have to be books. Now whether you get that book online, that's fine. But, you know, because obviously a lot of libraries now have books online. So whether you go to the library and get the actual book, or find it online that's fine with me as well.

These teachers define 21st century digital learners through three weaknesses: a lack of patience, including the need for instant gratification and the misunderstanding of effort required in learning. Having this knowledge allowed teachers to guide these changing learners to use iPads appropriately.

From teacher self-reported experiences of the use of the iPads, two generalizations can be drawn about teachers understanding of learners: understandings of learner differences and the characteristics of 21st century digital learners. First, teachers used their knowledge of their learners' differences to find ways to integrate iPads to support student needs. And second, teachers relied on knowledge of the 21st century learners' strength and weaknesses to guide the appropriate use of iPad in an educational context.

4.2.2.3 Understanding of technology integration as trial and error

All teachers reported the knowledge of the teaching and learning process consists of trial and error in finding what works with learners. This understanding allowed teachers to experiment with the use of iPads in their own classrooms to discover appropriate apps that support their different lesson activities. Also, they
were able to accept the iPad integration process is a gradual but continuous process, helping them maintain their effort to evaluate and modify the lesson to integrate iPads to enhance teaching.

LHS: *I don't know if they're [apps] going to be effective, I just try my hardest to help the kids. It's like trial and error.*

BHS: *I think just trial and error. Try this, did it work? Good. Do it again, yeah. Did that not work? Were the kids looking at me like, what are you talking about? You know, just trial and error. Because, if I think something's going to be great, whether it's with the iPad or not, and then I do it with the kids, and it's great. That's awesome. But, if it fails, then I've got to change it.*

AHE: *It was a trial and error. You had to take a little time on your own to plan out what you were doing to do, how you were going to integrate it. But you get used to it.*

MMS: *Everything is trial and error. It is with anything... sometimes with the iPad, you think it's gonna be really awesome and then all of a sudden all messed up. But sometimes you get better when you do it. You learn your mistakes in the beginning, and then it gets better throughout the day. That's common for any lesson. Doesn't matter if you're using the iPad. It's like a practicing. We have four chances everyday to practice just one lesson. By the end of the day, they get an awesome lesson. The beginning is a little bit rough and scratchy. You feel bad for your lab, but it gets better. But I mean, it's the same with or without the iPad.*

The above teacher reports clearly show the importance of the understanding of trial and error when integrating iPads in teaching. These self-reports suggest that this awareness enable them to persistently to adapt iPads more effectively into their lessons.

4.2.3 Technological knowledge – iPad capabilities and limitations

In this section, I highlight elements of technological knowledge related to the iPad, based on reported teacher experiences. All participants reported knowledge of
technology, particularly two elements: (1) Understanding of iPad capabilities, and (2) Understanding of its limitations.

Three specific iPads capabilities were reported by teachers: multimedia, Internet, and apps. The first multimedia capability and its usage was represented in the following three comments.

LHS: I want my students to create their own videos using iPads, because my assumption is, especially with the population that I work with, because multi-modal and being able to express things is a lot better way for them to demonstrate their learning. So project-based assessments with the special education population is a really good tool.

WHS: In science we also use it as a data collection. For example I used it in a 9th grade class where they took a film of a bug running along a meter stick back and forth to show distance and displacement and then we calculated speed and velocity and the same thing, it had a timer on it and they were able to pick the picture of the thing and then go over it slowly and get the time whereas before they'd have to you know, yell it out and someone keeping time and writing it out here they can take their time and film the thing and go through data slowly. Special kids are a little bit slower. What did you say, five seconds now? What am I writing? Three? Oh this is 10 seconds now? How many now? It's like they're not fast enough to keep up with the data. They can let the data collect and go through it on their own spare time in a timely fashion, whatever works for them. So that worked out good too.

THS: What the iPad is really good at doing is helping students in a different sort of way, communicate the solutions. Instead of communicating that solution by writing the graph down and handing that graph in, which of course they would have to do on a pencil and paper task...With the iPad they took a snapshot of what each of the three solutions were, so they could have that as documentation. Then they could include this in their eventual PowerPoint presentation.

Teachers had not only the knowledge of photos, videos, multimedia capability of iPads, but also knowledge of how to use iPad Internet to extend learning beyond individual classrooms.
KMS knew that iPads could download and play online videos. KMS used the iPad camera to document his class experiments and shared them on a class website to enable students to review experiments and gain better understanding of the content at their own pace.

KMS: Sometimes with science things happen kind of quickly, and you can't really see what exactly is happening. So I will go ahead and record experiments, then now we can go back and have a discussion about it the next day, about what exactly it is that we saw... then I will post them on to my website. So when they are studying, they can just go back and re-watch the lab again, which I think it was really helpful last year. We kind of get like, like, the "ah-ha" moment, like so say "ah-ha, I know how that works." With the video, they get that. Or there might be some shy kids who didn't get it at first, but they kind of go back to their own home, and watch it at their own pace, and then get it.

These teacher experiences demonstrated teachers’ understanding of both iPad multimedia and Internet capabilities. With this technological knowledge, teachers exploited iPad multimedia and Internet capabilities both to create constructive learning, which these teacher participants discussed as a salient feature of pedagogical knowledge (see 4.2.2.1.2), and to develop their own supplementary teaching resources (see 4.2.2.1.1).

The third knowledge of iPad capability includes iPad apps. The following two participants elucidate the functionalities and usages of apps in the classroom, implying their knowledge of iPad apps.

BME: Teaching English, Pages is important because that’s word-processing. iBook's for when we were reading a particular book that allows students to highlight and take notes in a book that they are reading. And the Google Drive app, because then students can access their document anywhere. I've also used Keynote, which is where students can create a presentation, kind of a PowerPoint but for the iPad. And we used Popplet. That's really great for brain storming ideas. So that students can create a quick brain storm their ideas. So I will use that.
BMS: **Keynote is great** if they're doing a more extensive project. This [Popplet] was a one-page article, so it felt like the quickest way for them to just create something fast. It was like a one-day thing. I feel like **Keynote would be better for something where kids are researching a major topic and they need to present the key findings. But a Popplet is quick for brainstorming or quick for just a visual to show us, “Okay, what was your article, what were the three main points, and what was the author’s purpose.”** So, they just had four things that they were sharing with us, and that was it.

PHS: What I would do previously was, I’d print out copies of the notes which is great, except if you lose your binder or if you’re disorganized, you might struggle with that. Those two things usually go hand in hand. So what I did was, I used Google Drive and uploaded my notes onto Google Drive and shared them with the students. I couldn't do this before because I would have no way.

Teacher discussions highlight that they had the knowledge of three iPads capabilities, multimedia, Internet and apps. The data showed that this knowledge provided the direct link between their instructional needs and iPad capabilities to support teaching and learning.

Along with iPad capabilities, teachers also reported their understanding of the limitation of iPads in teaching. The following two teachers noted the limitation of iPads: Flash does not work on iPads.

KMS: **Flash player doesn’t work on the iPad.** The first time I tried an assignment, and they got to like to fifth link and it was flash player, I didn’t know it was a flash player, because I did it on my laptop. It was fine on my laptop. It doesn’t work [on students iPads], then it’s kind of uh-oh what do you do, the kids get frustrated because what do we do next? and then you kind of have to roll with it. So that was frustrating that I would have to go. So we did it as a class like on my laptop is what we did there.

WHS: I've spent a lot of time looking for resources then we switched to iPads. All those resources, not all of them, but almost all of them didn't work anymore because Flash doesn't work. So I've had to look for other resources for iPads.
The discussions above show that teachers understanding of the limitation of iPads helped them adopt the appropriate classroom resources.

The key elements of technological knowledge discussed by teachers include iPad capabilities and a limitation. The knowledge of iPad capabilities and limitations allowed teachers to link between classroom activities and iPad capabilities while also adapting appropriate resources to meet classroom needs.

4.2.4 Summary - Teacher self-reported knowledge

All teacher participant discussions imply that each type of knowledge: content, pedagogical, and technological, was necessary for them to integrate iPads in teaching. Teacher content knowledge was assumed based on their Massachusetts teacher licensure regulations and their years of teaching experience.

Analysis of the participating teachers’ self-reported pedagogical knowledge, based on interviews, classroom observations, and classroom documents, yielded three sub-categories: understanding of goals, understanding of learners, and understanding of technology integration as trial and error. According to the data, the understanding of goals was an initial step to focus on what is important to benefit student learning with iPads. These participating teacher discussions also revealed their understanding of learner differences enable them to support learning preferences with the use of iPads. Their knowledge of the 21st century learners’ strength and weaknesses enable them to guide the appropriate use of iPad in educational context. Their understanding of technology integration as trial and error helped them overcome any mistakes that they made in using
technology in the classroom and to continue to patiently try to integrate iPads effectively into their lessons.

The participating teacher self-reported technological knowledge, reported based on teachers use of iPads, includes understanding of iPad capabilities and a limitation. They reports showed that they relied on this technological knowledge to assess the feasibility of iPads to support their instructional needs and then to put them into practice. Overall, the participants’ experience demonstrated that teacher content, pedagogical, and technological knowledge contributed to their ability to utilize iPads effectively in teaching.

4.3 Teacher Skills Teachers to Integrate iPads Through Curriculum

All twelve participants reported two types of skills to use iPads in teaching: instructional and technological skills. Analysis of the data yielded four sub-categories related to instructional skill: (1) skill to evaluate lessons, teaching resources, and tools, (2) skill to individualize instruction, (3) skill to manage classroom, and (4) skill to relinquish parts of their role as authority figure and as resources of knowledge. Data analysis also revealed and three sub-categories related to technological skill: (1) skill to modify digital documents, (2) skill to transfer digital files into iPad acceptable formats, and (3) skill to file share using cloud services. The next section details participants’ self-reported skills based on interview data, classroom observation notes, and materials analysis. The interview data is presented in bold because it was more salient to the findings.
4.3.1 Content skill

As I discussed in section 4.2.1, all my participants were legally licensed teachers and had taught in average 9 years in Massachusetts. So based on the regulations for teacher licensure in Massachusetts, I concluded that all twelve participants had professional skill to illustrate ideas and concept of subjects.

I also witnessed my participants' sufficient content skill during the classroom observations. All teachers clearly presented lesson topics and procedures to students. They used both assigned textbook along with diverse online resources that they valued to supplement their presentations of the concepts. Also, when students asked questions regarding the lesson content, teachers were able to answer the students' questions verbally, often supported by online visual aids.

4.3.2 Pedagogical skill

Teachers reported four different skills to support teaching by using iPads. The four pedagogical skills were (1) skill to evaluate lessons, teaching resources, and tools, (2) skill to individualized instructions, (3) skill to manage classroom, and (4) skill to relinquish parts of their role as authority figures and as resources of knowledge.

4.3.2.1 Skill to evaluate lessons, teaching resources, and tools

All teachers reported the use of evaluation skill to incorporate iPads into their teaching. Throughout the interviews, three specific sub-skills were identified: skill to evaluate lessons, teaching resources, and tools.
All participants reported that to determine when or how to use iPads to benefit teaching, they needed to evaluate lessons before and after integrating iPads. The following examples illustrate teacher use of evaluation skills to analyze traditional lessons and to identify the usability of iPads.

**BMS:** We needed to find a place to use it that this [iPad] could enhance our curriculum but it doesn't take away all the work that we've done and all the lessons that we've made, you know, that those are still awesome lessons.

**BHS:** That summer, I went through all the stuff I was going to teach that year and see; 'okay, what do I need to change here, what do I need to add here, what can I add here, how can I incorporate the iPad more here?' So, I don't really think I had to blow everything up and start from the beginning. I just had to see what I had and see what went with the iPad and what didn't.

**PHS:** I had to figure out what I was looking to do. I think that that's the hardest part. You have this piece of technology [iPad] but what do you want to do with it? And I had to kind of think of, "Okay, here's what I do. How can I improve what I do by using the iPad?" and "what do I have to do totally different?" Because that for me it was an easier transition than to go: I'm going all iPad and get rid of everything. I needed to have some kind of bridge to tie those together. And then also how could I use it to enhance what I'm doing.

All teachers explained that they evaluated previous lessons to integrate iPads. Two teachers discussed a misconception of iPad integration and how evaluation alleviates it.

**MMS:** When people start getting anxious about using the iPad, they think that they have to completely re-design the wheel. You don't have to re-design the wheel. What you need to do is find out how the iPad melts into your current lesson. Like, you find out how can you use the iPad to make your lesson better...I still don't use the iPad every day. I don't. Because it doesn't always lend itself to the activity that we are doing. But, if you CAN use it, and you can make learning better. That's when you integrate the iPad.

**BME:** The idea is we're not creating new lessons just because we're using the iPad, we're teaching what we need to teach but using the iPad
to help us do it. So, it wasn't like we were creating brand-new lessons necessarily... We're teaching what we've been teaching just using this to facilitate that.

Whereas most teachers reported their use of evaluation skills to modify their traditional lessons to integrate iPads, one teacher explained the use of the skill to assess student projects to evaluate the efficacy of revised lessons with iPads.

WHS: Sometimes it [lesson] works and sometimes it doesn't. That's what I'm trying to say. Sometimes the curriculum fits the project [with iPads], sometimes it doesn't. Sometimes you give them [students] that part and it will turn out worse because there's just too much material for them to go through. So while they're presenting it [projects] I can assess it [lesson].

The above examples demonstrate the necessity of evaluation skills for teachers to determine the usability of iPads through assessing both teaching as a process and learning as an outcome.

The second occasion for teachers to use this skill was to evaluate teaching resources. WHS and BHS further discussed their evaluation skill to supplement traditional teaching resources with online resources. They used diverse supplementary online resources, such as textbook, worksheets, and online videos to support students' learning processes and deepen their understanding of content through those resources rather than being limited only to the required textbook. To achieve this goal, they needed to evaluate their textbooks to determine what could be effectively supplemented with online resources using iPads. BHS and WHS articulated their evaluation process:

BHS: What I do is I take the textbook and I go down, okay, that's enough information. Oh, I think this topic needs more information. And then I'll go and find videos or pictures. I mean, someone else could take the same book and make a totally different book because their opinion is different. And if I teach new classes, I'll make new ones.
WHS: As opposed to in the book, the traditional book that we have, most of them aren’t colored pictures. They’re just drawings of what the leaves look like. Or what the scales and needles look like. And they don’t tell you what the whole tree looks like. There’s not enough room for that volume of information. It [iPad] allows them [students] to see the pictures, what the plant looks like, how the plant is used in real life. For example, they show shrubs, and they show it as a foundation planting along with other ones. Plus, it allows them [students] to get really specific, show you just basically that this is a fir. Each one is different...so they are very different from each other. In color and everything very slight variations... you could never get that many pictures in a book and give it to the kids.

Teachers’ evaluation skill was not unique to assessing teaching resources. Some teachers also reported the use of the evaluation skill to gauge tools.

All teachers perceived the iPads as a supplementary educational tool that required evaluation to identify differences between using traditional tools and iPads to determine the most influential benefit for learning. The following three teachers specifically explained this.

BME: Could they have made something like this [Poppet Poster]? Yes. Would it have looked like this? No. It would have been on a piece of paper. It wouldn’t have looked as professional as this. But, the other advantage to having it as a digital format is that we can quickly and easily project it. Now, could I put a piece of paper under the document camera? Sure. But, what’s great about is that each group could email me their Popplet so then I have it all in one place, and I have every kid’s work right in front of me as opposed to having them collect all these papers. So, could we do this with paper and pencil? Sure. Would it be as streamlined and as put together? Would it be as quick for them to do? Probably not. It probably would have taken them longer.

OME: One of the benefits I can say right now is, if students are reading a book, and they come across a vocabulary word that they don’t understand, they don’t stop and look it up in a dictionary. They don’t stop, and walk to their laptop to type it in dictionary.com. They just skip over it. Where it definitely affects, in a good way, with the iPad is that all they have to do is click on the word they didn’t understand and they get it. So I think that's very helpful in terms of increasing vocabulary. Because they are more apt to look up the word if it's easy to do versus old fashion way. That's a positive thing.
BHS: Instead of carrying [textbooks] around, it's right here. And so, what they can do is they can open it in this app called Notability, and it almost becomes like a college book, because they can write on it, and I know especially in the Honors-level classes, what the kids are doing and what they started to do then is they would highlight things, they would write in the margins, like "study this". So, it's almost a form of independence because they don't have to worry about ripping the book and covering it. They can't write on the book. But, with a PDF version of the textbook, it's theirs.

Teachers reported that by comparing and evaluating traditional technology versus iPads, such as textbook versus iBook, they were able to understand how the iPad technology was able to improve certain aspects of the teaching and learning process.

4.3.2.2 Skill to individualize instruction

Section 4.2.2.2.1 presented the participating teachers' discussion of their knowledge of learner differences, such as their previous knowledge and their various learning strengths and preferences. Based on this understanding, all twelve teachers reported that they tried to individualize their instruction to meet different student learning needs. The following two teachers discussed their skill at individualizing instruction in the classroom to guide students’ different technological skills in using iPads to develop their projects.

THS: We basically give them an assignment and the purpose of the time that we’ve given them in class was just get the Haiku Deck [iPad app] up and running. Some students already knew how to make a presentation. Others are just totally clueless about it. So they work together in pairs to make one presentation. So if one kid knew what was going on, and the other one didn’t, then I pretty much leave them alone... But if I have two kids that didn’t know what was going on, that’s when I want to be able to give them step 1, step 2, and step 3. ‘Do those three steps, try the fourth and fifth steps which you can do. I will be back to you’ I just kind circulate around. Once you get them moving, hopefully they will keep
moving. But if you can’t get them to ‘figure out on your own’ Some kids’re just gonna flat out, give up.

MMS: They just finished a 'bacteria's most wanted poster', and I made them do it in Pages...They started in class and they had to finish it for homework. I always like the kids to start iPad projects in class in case they have questions. Some kids still don't even know how to change the color of a font yet. So, it's nice when they can share. And, they learn from each other. They will ask each other the look; how did you do that? And they help each other out.

One teacher gave specific example of accommodating different levels of student subject knowledge by distributing and allowing students access to different instructional materials on their own iPads.

KHS: this [Web Quest] is great when I have to differentiate instructions to different students. So some students are really hungry like for the information they want to know more. So by accessing these websites using iPads, there are so many links within this website that they can go to, so the kids that work fast then they can go ahead, and get so much more information. They can find them on their own. If students need a little more assistant with that I also give them directions exactly. So sometimes I will give this other students, tell you exactly where to click, click on Transmission, so that students a little more help, I will give them a slightly different document, other students would not be able to tell, they are slightly different, but I can give them few more directions, that's how I can differentiate my instructions too. Some students need more assistance, but maybe they don’t want to look like they need more assistance.

Unlike others who differentiate their instruction or lesson materials, one teacher described a specific strategy in supporting individual learners by providing options of learning tools, both iPads and traditional ones, and enabling them to select what suits their learning capability.

LHS: I give them the choice. Most do it on the iPad now. For example, [Student T], who is a good student, has very poor penmanship. Her writing is awful, and it doesn't show the skill she is capable of. But, [what] if she can type them and send them to me? She did a very good job typing those.
While teachers had different purposes for individualizing instruction, for example, to support different student skills in using iPads, to aid different levels of student subject knowledge, and to support student capabilities, teacher reports refer to the benefits that iPads afford to individualized learning and reflect teachers’ skill to individualize learning through iPad use.

Along with the skill to individualized instruction, all teachers discussed the necessity to develop skill to manage appropriate iPad use.

4.3.2.3 Skill to manage appropriate iPad use

All twelve participating teachers noted that classroom management, specifically in terms of appropriate iPad use, is an important challenge. The majority of teachers reported the use of communication as a common strategy to manage student off-task behavior with iPads, called “iBad” behavior by teachers at one school. Teachers reported different types of communication, such as straight-forward or joking to discipline student “iBad” behavior.

Four teachers reported applying straight-forward communication about their rules and expectations as well as the consequences of “iBad” behavior to teach responsible use of iPads in the classroom. The teachers reported that they intended to establish their responsibility and authority through communication, to set clear guidelines about when, how, and what to do with iPads.

KMS: So this year I started what’s called the responsibility rubric. So, what’s that entail? So each week students get 10 points for being a responsible student. So I taught them the first week what a responsible student is. You come in on time. You come prepared, iPad is charged. You have homework done, you’re respectful, and then anytime you do
something where you’re not being responsible, I take a point away from 10 points you have. If you’re using the iPad when you’re not supposed to, I let them know that you are using the iPads when you are not supposed to and they’ll see me make a check on a clipboard, knowing that I am taking a point away from their grade. That tends to motivate them to not really want to do it.

BME: I think it’s just those really clear limits, setting those limits from the beginning, being really clear about what you can and cannot do and really enforcing those becomes very important when you’re giving a kid a device like this. Be very clear on the expectations and what you expect, and that you reinforce those consistently.

PHS: I’ve found that you have a conversation with the student. And you say this is when you can use it, this is when you can’t. And it allows the opportunity to have that discussion. And you have to give them technology in order to teach them how to be responsible with it. You can’t just prohibit it and say, “be responsible” and never give them the opportunity to try.

OME: You have to really make it clear when it’s okay to use the iPads, and you also have to make it clear what the consequences are if they go against that rule. You have to warn them first and tell them that you should only use your iPad when I tell you to. If you use it when you’re not supposed to, the consequence is that I will take it away, and you really have to follow through by doing that. One mistake by one student is all it takes, because they need to know that you really mean business, that it’s not just an empty threat. And you will really give it to the assistant principle for the day. And you have to go and pick it up from her at the end of day. So they have to have a conversation of why it was taken away from the first place.

Another teacher described the use of joking style to react to student off-task behavior with iPads and to warn them about inappropriate use of iPads in the classroom.

BHM: If you're going to scream and yell at them, they're not going to listen to you. So what I try to do is make a joke out of it. Like if they're trying to text on their cell phone, I'll be like, “Oh hey Jimmy, did you find that information on your cell phone?” Like, try to make a joke out of it. you know, make it known that, “Hey, you need to be doing work” So I mean I could take the iPad away...but if I take the iPad away, now I gotta go print out the worksheet, I gotta go get them a text book, it makes it harder for me, you know, since we are using this, so it’s the dance we
have to do. Are they doing it? And if they're not doing it, why aren't they? Why are they on Facebook? Why are they playing a game?

WHS: I know when a kid is taking more notes than I'm putting up. I can tell they're writing far too fast. There's not enough up there to write. So I'd say “what are you writing a book back there? I put up one sentence so far.”

These teachers expressed that this joking style guided the students back to learning activities rapidly and so beneficial rather than punishing students.

When asked in the follow-up interview to explain about the difference between punishment and communication, teachers who reported this style explained the ineffectiveness of immediate punishment for iBad behavior.

PHSS: I guess you could give a detention for every time a student wasn't on task, but let's take the iPad out of the equation. If a kid wasn't, every time a kid wasn't on task, before the iPad existed, were you giving detentions to them then? Probably not. You know if a kid is zoning out, looking out the window, did you say oh, detention. Probably redirected them, hey look I'm over here, not out the you know, not outside. So and now just add the iPad. Are you going to give a detention or whatever to a kid every time they're not on task because of the iPad? I mean if it's one or two, no. But if it's a constant, yes. You know, if a kid, like the kid I've taken the iPad from three days now out of five, but if it's once in awhile, someone's looking at Facebook, I find it more helpful to redirect them in a different way than yelling at them. Because they're gonna, if I yell at them they're probably gonna shut down for the rest of the class and then probably do it again tomorrow just to spite me.

WHS: It [punishment] won't be helpful. Punishment and rules are only as good as they can be enforced. How do you prove that the kid was on another site?

Overall, teachers reported that guiding students to use iPads in the classroom entails having clear communication with them about classroom rules, expectations, and consequences and continuously reminding students of the responsible use of iPads in the classroom.
4.3.2.4 Skills to relinquish teacher role as resources of knowledge

Teachers with skill to relinquish parts of their role as authority figures and as resources of knowledge reported that they were able to overcome the fear of not knowing every detail about how to use iPads in the classroom. This allowed teachers to make mistakes regarding the use of iPads in the lessons and to collaborate with students to develop teacher technological skills and knowledge. OME explained this distinction.

OME: You have to be willing to put yourself out there, and admit that you don’t know something, and maybe students will know, maybe not. So you have to say ‘well, I will check that out with my tech person, and I will get back to you.’ Once you get over the fear of using it [iPad] in the class and sort of allow yourself to make mistakes, allow yourself not to have all of the answers to the questions, allow yourself to tap into the knowledge that your students have, once you do that I think you will be a lot, more at ease with technology. Oftentimes teachers feel like they need to know everything about everything. That’s not always the case.

OME was not the only teacher who reported this skill to relinquish the teacher role as knowledge source. Others also felt similarly.

MMS: Teachers can learn, too. I can’t tell you how many times a kid would do something. And I’ll say, “How did you do that?” I mean, I’ve been using it [iPad] for four years now, and there’s stuff that I still don’t know... I think that’s what makes the kids respect you more. It’s kind of like the new age. You always thought that your teachers knew everything. But, we don’t. We don’t know everything. We really don’t.

BME: I think that it’s a learning process, and that’s what’s kind of fun about it. You don’t have to be scared, just because you don’t know everything about it. It’s okay. We don’t know everything; I don’t know everything there is to know about English. And, that’s okay. I don’t have to know everything there is to know about iPads. And, it will be fine.

BME: You ask kids, too... The kids will tell you; what apps to use, and ways to do this. I mean, you learn a lot from them, too. They have things that they learn about an app, then they’re like “Oh, I can show us how to do that”. So, if I didn’t know how to do it, it was okay, because then, they could figure it out. And then, they could show us. It was great, because we
were learning together. And, that's what I'd tell them; "This is new for me, too. And, there might be things that I don't know about this app, and you might figure that out. And then, you can share it with us."

WHS: Ask the kids what they could do with the iPad first. Before you even suggest doing something. Say “Next week we're going to do an experiment.” Or “next week we're going to go on, go out and collect some things from the bottom of the stream and classify them. How would you use the iPad? What could we use” and brainstorm.

Most teachers reported that skill to relinquish the role as primary source of knowledge, knowledge of resources and more specifically knowledge of iPad as a resource, allowed them to view students as technology helpers and to use student technological skill and knowledge to incorporate iPads in teaching to design their digitally enhanced classroom.

The other aspect of skill to relinquish relates to appropriate use of technology, specifically iPads. As discussed in the previous section, student “iBad” behavior was a considerable challenge for teachers when integrating iPads (see 4.3.2.3). Teachers reported that the skill to relinquish perfection in the teaching process allowed them to keep from micro-managing students.

MMS: You have to understand that some kids are gonna play the cookie game when they should be doing the WebQuest. There’re gonna be checking at the sport scores when they’re supposed to work. You have to be okay with that. You are not happy about it, but you have to be okay because your back is turned. You cannot please every child at once. You can’t do it. So you have to hope that you have gathered the majority of your children in that one particular lesson are doing the right thing. And if you can accomplish that, then it’s been a positive experience.

WHS: If I said something to every student that was doing something I would not get any teaching done, so the management is just spot here and there, you need to focus and just move on. I don’t make a big deal out of it. You’ve [teachers] got to pick your battles.

AME: I know that if I choose to sit behind my desk and grade the quizzes while they're working on getting their new vocabulary list [on their iPads],
there will probably be some students who are off-task. You just have to make those choices, be aware of that reality. So, what I'll do is I'll grade about half of the quizzes. I'll do a lap around the classroom, come back and do the other half of the quizzes.

Relinquishing the concept of perfection allowed teachers to focus on the overall benefits of using iPads in teaching and enabled them to continue using iPads in the classroom.

Overall, teachers reported four different instructional skills that they used to integrate iPads in teaching: (1) skill to evaluate lessons, teaching resources, and tools, (2) skill to individualized instruction, (3) skill to manage classroom, and (4) skill to relinquish. Along with instructional skills, teachers reported technological skills to develop digital educational resources that can support their teaching by using iPads, which is the next skill.

4.3.3 Technological skill

Participants already had used iPads more than one year. Thus, I assumed that these teachers already had very basic iPad operating skills, such as how to turn on/off iPads. I preferred to ask about teacher perceptions and experiences in using iPads, rather than imposing my own perspective through pointed, direct questions in the interviews. To identify primary technological skills that teachers need to use iPads, I interpret from a teacher's self-reported experiences those skills perceived to be necessary.

One teacher reported that he did not use iPads in the first year due to his lack of technological skill. However, he reported developing his technological skills during the first year and being able to comfortably use iPads in the second year. Technological challenges that he faced, suggest the primary technological skills that teachers need to
develop to incorporate iPads in teaching. Also, I examined my classroom observation notes and documents.

There are two sub-sections in the section. The first section explains the process of identifying the teacher. The second section discusses technological skills reported based on the interview with the selected teacher and analyzed based on the classroom notes and documents from all participants.

4.3.3.1 Selecting an illustrative participant

Nine out of twelve participants reported high comfort level of using iPads and classroom tools, such as Apple TV and SMARTBoard. These nine participants’ confidence and comfort level of using technology are addressed in the interview data.

BHS: To be honest, I didn’t really need that much help because I’m comfortable with it. Not that I didn’t pay attention [to Professional Development], but I was sort of focusing on myself... I can’t speak for other people, but I liked it because I’m comfortable with technology. I was ready to go.

BHM: I’m pretty comfortable with technology but other people might not be, so they need to get more one-on-one attention.

PHS: as far as the day-to-day instructional techniques, I feel very comfortable using the iPad and doing different stuff on it.

KMS: I just try, I will be at home, just playing with apps, and so far figured them out on my own. With my age, I feel like I’ve been around technology as it’s been evolving, so I’m always on top of it. I think that helps out.

BMS: I might use it a lot more than other teachers because I already have a good background in technology. I think people have different comfort levels with that.

BME: iPad is very user friendly. So, I mean, I have an iPhone. So, that probably helped. I think you pick it up very quickly, so I don’t think necessarily people think “oh I need training for how to use an iPad”. I
think you have to be willing to devote a little bit of time. But, I didn’t feel like it was necessarily a whole new skill set that I needed to use the iPad. I mean, it is very intuitive. I think Apple designed it that way that there’s not a lot of guess work involved, and there’s a lot of similar features and functionalities amongst the apps that you use. You pick it up very it was easy. I thought, anyway. That’s just my own personal experience, but I thought it was pretty easy. I felt comfortable with it. I would say, it pretty much from the get-go.

MMS: It’s very comfortable for me. I am not scared of technologies. I am not afraid putting iPads into my lessons.

The above nine teachers reported their comfort using iPads, apps, and classroom tools on their own and designed their lessons with those technologies.

Not all participants felt comfortable using iPads from the beginning of the iPad integration process. Three teachers reported their lack of comfort level of using iPads and Apple technologies, and faced challenges incorporating them into their teaching. Of those three, one discussed at length his evolving technological skill.

LHS: My lack of just basic technology skills. And, that saying, the district does its best to train us in different things but a lot of times, you know, it’s an hour here or there. I find I need to use it for a long time before I’m really comfortable with things.

THS: I can do a lot of things on the iPad, but nowhere near as quickly as everybody else. I still have to consciously think about what I’m going to do next on that iPad. It’s just, it’s not natural. And I see the teachers slide things and moving stuff around, and you know like, “Whoa Whoa Whoa. Slow down here.” Everybody is telling me how easy it is, I’m doing this, I’m doing that, I’m like “yeah.” Trying to fit 10 gallons of stuff into a five gallon pail, you know. Or ten pounds of material into a five pound bag as I often will say.

WHS: Oh I don’t think they’re [the younger teachers] going to have much problem because I see them, they’re using two or three things at once. Oh let me email and do this and that. They live like that. I don’t live like that so it’s more of a challenge for me. I don’t think it’s much of a challenge for these young kids. They maneuver through the files like it’s, lightning speed. They’re way faster and adaptable. I know a lot of young teachers
and they just have no problems with anything. They know how to do everything and nothing's a real challenge. The technology is not challenging to them. So older teachers yes.

The above teacher reports highlight challenges some teachers experienced in integrating iPads in their teaching. While two of these teachers reported continued lack of competence using iPads, one teacher noted his improved competence.

LHS: Mr. D, He's smart. The poor guy, I drive him crazy because I always need help.

WHS: The kids know how to do this. Most of the kids know how. I didn't know how they'd accomplish it... You know so I haven't sat there and said, you know, let's talk about video use and putting, how do I get a timer on there? I don't. I just tell the kids you've got to find some way of taking a picture of this and having the clock on it too. All the kids know how to use most of the stuff. If someone doesn't know I'll say, "You tell them. You help them now." I don't even bother. Thank God they know how to use it because if I was the one they relied on I wouldn't be using it.

These teacher self-reports show that, even after two years using the iPad, they experienced and perceived their own struggles to incorporate the iPad and its related technology into the teaching and learning process. In contrast, one teacher's, THS, self-reported experiences allow for identification of specific skills required to incorporate technology.

THS: It took me all of last year to get comfortable with it[iPads]. I really didn't start to feel comfortable enough until this year. I was really hesitant last year... This year has gone much smoother than last year. I almost don't even want to talk about last year.

THS asked students and co-workers for help sometimes, but he felt he was able to "run at a full gallop" from the second year.

In analyzing and coding the data, one participant had gone through such a steep learning curve that his comments most clearly identified the fundamental skills necessary
to begin using the iPad fluently. To determine the primary technological skills that teachers need to use iPads, I interpreted THS’s experiences and examined classroom observation notes and documents from all participants to validate and generalize those experiences.

4.3.3.2 Technological skill

To determine teacher technological skill, I first examined the participating teacher’s technological challenges. Based on his self-perceived technological challenges in using iPads, the analysis of the data revealed technological skills that he needed to develop. To enhance the reliability of the technological skills found from the selected teacher’s experience, I also examined my classroom notes and teaching documents from twelve participants to determine if other teachers also applied those skills in using iPads in teaching.

The analysis of the data for reports of needed technological skills yielded three sub-categorizes: (1) skill to modify digital documents, (2) skill to transfer digital files into iPad acceptable formats, and (3) skill to file share using cloud services.

THS used to use papers and copy machines to create his classroom materials, such as worksheets. He did not know how to manipulate digital documents using software, and faced challenges in creating digital handouts.

THS: You know what I used to do? I used to make one copy and literally cut every piece out, put it on, tape it so that the kids had the space on there [worksheet]. So I would physically cut and paste. I should be able to electronically cut and paste. I can't do a cut and paste when it's in PDF form. See, your hands are tied so much when you're using the iPad because there isn't a whole lot of wiggle room.
According to THS, the first technology skill necessary to integrate iPads is *skill in modifying digital documents*.

THS used to use PC software to create classroom materials. He was neither familiar with nor knew how to use Apple software. He did not know how to convert his previous PC digital materials into iPad acceptable formats. As such, the second technology skill necessary to integrate iPads is *skill to transfer digital files into iPad acceptable formats*.

**THS:** *In order for it to work with an iPad it's got to be in PDF form. You can't use a Word document because it's an Apple product. You have to use a PDF. You can't use a Flash because it's an Apple. It's like you're kidding me. You're kidding me...* So when I first started I need to take all of our PC PowerPoint and convert them to whatever the PowerPoint language is that Apple has. I forget what it's called.

Because iPad apps are inflexible in the interaction with other software from Microsoft Office, to use their previous lesson materials from those applications, teachers need to have skill to transfer a file into appropriate digital formats.

**THS** used to distribute handouts in the classroom. He experienced challenges in digitally sharing his classroom materials, because he was unable to use software and tools for this purpose. The third skill, then, is *skill to file-share via cloud services*.

**THS:** *You have to save it in the cloud, which was a whole new thing to me. I didn't know how to save to the cloud...*

Distributing digital resources online is different from distributing paper classroom materials. Thus, teachers need skill in sharing teaching resources online using cloud services.
THS’s experiences suggest the interrelated importance of the three sub-skills: (1) skill to modify digital documents, (2) skill to transfer digital files into iPad acceptable formats, and (3) skill to file share using cloud services. He summarized his first year experiences, which suggests that the lack of these necessary skills significantly hinder the integration of iPads in teaching.

THS: It’s like there was so much change that went on all at once, for some people it was not a big deal. To me it was a huge deal. Because literally everything from learning to turn it on to converting the PowerPoint over, just everything was just totally new to me and it was really overwhelming last year. So I kind of put the iPad aside and kind of watched what everybody did and picked up on things at a comfortable rate for me. But this year when I started, I started running at a full gallop, you know what I mean?

The following discussion illustrates his development of the above technological skills in using iPad in his teaching, emphasizing the importance of those related skills.

THS: None of this stuff about Google Drive and saving it in Google Drive, I didn’t even knew anything about. All last year that whole Google Drive thing to me never existed. So, but this year I learned that okay, I’m going to take a PDF, I’m going to put it on Google Drive, then I’m going to have the kids, from a folder that we set up for the class, because now you’ve gotta... like how do we set this up? It’s like -- "really?" You expect me to do this and take all of my old stuff and convert it into this and be ready to teach tomorrow? Seriously? Most people were like, “Oh, it's not a big problem.” To me it was like, “Yeah, sure.” So I wanted to do it in a way in which I was comfortable. So I was extremely awkward all of last year. Now that I know how to do it, now I know how to save it, now I know how to maneuver it around, now I know how to call it back up. Then I can instruct my students using iPads. But until I actually experienced it for myself because whenever somebody says oh it's real easy I say boy that's a line of bologna, that's just a sales pitch. Now it only takes me two seconds to do because I'm past that learning curve.

His increased competence was further evidenced in the follow-up interview when I asked if he had used the iPad to create teaching materials.
THS: I used it [iPad] to create a review sheet and a test. I used Type On PDF. It was just easier for me to create a template like this and go and put these images in on the iPad. Just easier for me to do that. Okay, so what I would do, I search for an image, and then with the iPad I can highlight that image and put it in... Some things are easier to do on the iPad, some things are easier to do on the Mac Pro. So whatever is easier or more, I shouldn't say easier, just more efficient is probably the way to do that.

The above discussion highlights not only THS’s increased technology skills, but also his technological knowledge, that is his understanding of iPad capabilities (see 4.2.3).

For THS’s experience to be broadly important, it is necessary to validate those experiences through analysis of interview data, classroom observation notes and documents from all participants. THS was not the only teacher who emphasized those technological skills. One teacher explained why the skills are important.

AME: You have to be able to kind of do it all on your own because nobody teaches out of books anymore. They don't buy us new books anymore. The books that I'm using are from when I first started teaching and they're falling apart. And so it's important to be adaptable and to use the iPad.

The above three technological skills were also identified and triangulated through classroom observation and document analysis. For example, classroom observation revealed that all twelve participants used digital teaching resources developed by using diverse software, such as Microsoft office, iWork, and apps, showing their skill to digitally create and manipulate documents. To share those files, they used email or diverse cloud services, such as Google drive and DropBox, depending on their preferences. Analysis of classroom resources revealed that ten out of twelve participants have their own websites or Blogs where students can access and download classroom resources, showing their capability in sharing diverse files online.
Based on analyzing skills that THS needed to develop his challenges and classroom documents, those three technological skills are primary skill that teachers applied to use iPads in teaching.

4.3.4 Summary: Teacher self-reported skills

Analysis of the data collected in this research revealed three areas of teacher self-reported skills: pedagogical, and technological skills. Teacher self-reported pedagogical skills—based on interviews, classroom observation, and classroom documents—yields four sub-categories: skill to evaluate lessons, teaching resources, and tools, skill to individualize instruction, skill to manage appropriate iPad use, and skill to relinquish. To determine teacher technological skills, I selected a teacher who noted his development process in using iPads in teaching, and interpreted from his self-reported experiences those skills perceived to be necessary. To enhance the validity of those skills discovered through this teacher’s experiences, I also examined the classroom observation notes and documents from all participants. Based on the data, analysis yielded three sub-themes related to technological knowledge: skill to modify digital documents, skill to transfer digital files into iPad acceptable formats, and skill to file share using cloud services. Overall, participant reports illustrated that teachers relied on both pedagogical and technological skills to use iPads to support teaching.

4.4 Teachers Motivation to Integrate iPads

Analysis of the data on motivation identified four primary reasons to integrate iPads among participants: (1) perceived student engagement, (2) convenience, (3) reliable
accessibility and immediacy of iPads, and (4) preparing students as 21st century digital learner. Participants did identify one-of, individual motivations. For instance, one teacher reported "presence", "possession" or "peer pressure" as a reason to use the iPad; however, the purpose here is to summarize the most commonly reported motivations for the educational use of iPads.

4.4.1 Perceived student engagement

All participants reported motivation to use iPads in teaching because they perceived a positive influence on student engagement. They reported that because students were excited and actively involved in lesson activities they were willing to use iPads for educational purposes.

For example, the following teachers explained their feeling about student engagement when they used iPads in teaching.

_BHS:_ They've grown up on technology, video games. They all have iPhones when they're like eight. _If I'm not using it, then they're probably going to get tuned out._ If I'm just using the textbook and that's it then they're probably going to get bored. But if I'm using technology, if I'm on Prezi, or if I'm on Google Drive or even if I can incorporate Twitter, it's going to catch their attention..._In my opinion [students] are engaged more in learning._ They might be bored, They don't like history. But with iPads I feel I'm doing things to engage them more than I could do two years ago. It's awesome.

_THS:_ Once the kids have made this then they take a snapshot of it [using iPads]. When it would come time to do a review, "Okay Johnny flash it up, tell me what this one means. _Now it's fun for them because it's new and_"

---

1 BHS: They have it, I might as well use it, you know? I don't want to be the teacher who doesn't use it, you know? Why have it if you aren't going to use it? I distinguish this motivation from immediate and convenient accessibility. See 4.4.3.
exciting for them, okay? So, do you see how the iPad would come in? Because this is new and exciting technology the kids are more engaged by using the iPad.

KMS: Students are really excited in using iPads. They can't wait to use it. That's why I don't want them to fight that. I try to have them use it. It's hard every day, but I will say DEFINITELY three times a week using it for something, maybe not the whole class period, but definitely for something. The more I see them into [iPads], and engaged and excited, the more I want to use [iPads] for them. So I want them to have fun while learning in my class. That’s a big philosophy.

While the above evidence generally illustrates a shared motivation to use iPads for educational purposes—the positive influence on student engagement, not all teachers had the same understanding at the beginning of the iPad integration.

OME reported that for her there was a lack of consideration of teacher opinions in the iPad integration process. As a result, she was reluctant to use iPads when her school first decided to use the tool. However, after she witnessed positive influence on student engagement, her perspective changed, motivating her to use iPads.

OME: At first we were a little, like I said skeptical because we kinda felt that we didn’t have much to say in the process. It was just say, we’re getting them, you’re using them, you better learn how to use them. Because this is the way it's gonna be. So I think, maybe some teachers were little more reluctant to use it because they felt forced to do it. But then we had the freedom to use it or not use it. It wasn't like we had to use it. But you know the kids were excited about them. So that was another incentive too, if it is a way to engage to students in learning, why not use it?

While the majority of teachers discussed the student engagement as a motivation factor, some teachers also noted that the use of iPads does not guarantee student engagement or excitement, leading to teachers’ demotivation to use the tool.
A teacher illustrated a specific example and reported that how her students’ negative reaction influenced her decision on using an educational app. LHS thought IXL math was a great educational app to reinforce students’ mathematical skills. She covered the cost of the app for her students and used the app until her students stopped enjoying using it to study.

*LHS: IXL Math, it was a good app for somebody that's a low-level student to reinforce their math skills. The good thing about it, it was very definitively leveled, you know, addition, addition with regrouping, and then subtraction, and subtraction with no regrouping. I had paid for that. I paid out of my own pocket because there really wasn't a budget for that last year. The kids loved it for about a month, and then it was so repetitive and boring, they hated it. It was like “No not again, do we have to do it?” You don’t want to give homework on it. So I didn’t renew it this year. I just had to make a decision.*

In general, positive student learning attitude was discussed as a motivation factor by most teachers. Some teachers explained why that motivated them to use iPads, adding deeper understanding of the motivation.

One example is BME. She said when students are excited and engaged in learning activities, they put in more effort and this led them to achieve unexpected learning outcomes. These unexpected learning outcomes excited her to use iPads in teaching.

*BME: If the kids are enjoying it, and they're having good time with it, then, it makes your job as a teacher a little bit easier. They're excited to use it. They're excited to work with it... That's what I really love about this. Sometimes you’ll envision what you want the kids to do and, they'll take it to the next level. I gave them some guidance, but they created these things that I just wasn't even expecting. They'll make something with it that you didn't even think of. Or, they'll really put all this extra energy or effort into it.*
Another commented that when students are actively involved in the learning process, students can remember the content better. This belief motivated him to change his traditional lessons to integrate iPads in his classroom.

THS: In the past, I demonstrated for them. They were just passive participants, looking. If you are actively involved in the process, you’re gonna remember for a longer period of time. That’s my objective. Take some of the old lessons that we had, and make them much more student interactive. And that, I know, allows students to remember the materials for a longer period time.

To summarize, the most common self-reported teacher motivation is witnessing student positive learning attitude when students use mobile technology.

4.4.2 Convenience

Convenience is another motivation for teachers to integrate iPads. The following teacher discussions reveal how the use of iPads helped them to conveniently complete their tasks, in terms of distributing classroom documents, grading and collecting outcomes, preparing teacher effectiveness documentation, and communicating with students. For example, BME noted that the use of iPads helped save time and effort in terms of distributing classroom documents.

BME: One advantage to using this is if I need to give students handouts... 3 page story times 80 kids times three pages each. That's a lot of paper. And, it's so much more convenient to just load a document onto my Teacher Web. And, have them open it up and have them read it. So, that's really great. I've really enjoyed just being able to say, "oh, we're just going to open up our iPad, and I don't have to run to the copier" So, that's really great.
While BME explained the convenient distribution of classroom materials as a motivation to use iPads, other teachers further explained the perceived benefit of using iPads to handle student misplacement of classroom materials.

By distributing digital classroom resources using either email or cloud services, teachers noted that they were able to not only conveniently share the materials, but also be assured that students had permanent access to those resources.

**BHM: If they took away the iPad I'm going back to printing things out. Kids losing things, writing the notes on the board myself. No mass emails, you know? I can send one email to the whole class.**

**THS: In the old days they would write it out by hand which is not as exciting as doing the type on PDF. We used to say, "Okay, copy the graphs down." What would they do with these graphs? They'd put it in their notebook and within five days what would happen to it? They lose it, they misplace it, alright? They can't find it, the dog ate it, whatever.**

**PHS: That tells me that the students have it once because I handed it [classroom material] to them but if they've lost it or they lost their binder which is very common problem, then they don't have them. So like yes, I gave them to him and I can check that off as I gave it to them but the reality is on a day-to-day basis kids lose things. They can't lose those. Because I shared them with them. So that takes care of that.**

The data showed that the participating teachers found that posting course materials online rather than making copies was a better use of their time, resources, and effort. Another use of iPads that teachers perceived to be convenient is for grading and collecting students learning outcomes.

Using quiz apps, such as Socrative, participating teachers reported that they were able to not only save time grading, but also were able to collect assessment results conveniently and quickly. This instantaneous assessment data informed teachers about
their students understanding and helped them modify their instruction for the next lessons.

AME: Socrative, the app, will grade it for me. That used to be something I would just grade, by hand, in class, while they were working on another activity. Now, that saves time because all I have to do is record the grades from Socrative into my iPad.

BMS: Socrative [app] is something that I’ve really enjoyed using and this is a way to use exit cards. I asked them “What’s listed at the end of the book?” I could give them multiple choices. I could have them do fill in the blank. This one was a lot like the clicker system that we had but the clicker system never worked effectively. This, I could get a little quick quiz. I can get data like that [Snapped fingers]... Everybody goes at their own pace and then at the end, it sends me report and so I can go and see how many students knew these terms. I could say, “Ah. I need to go over that one.”

PHS: This is just a little review of the thing we did the day before. And as you can see, this gets emailed to me. So, I say to myself, ‘well, my students are able to identify the GCF’. This, right here, and it’s not about getting 100%, like, you want that ideally, but, I can see that one, two, three, four, five, six people got that wrong. The rest of the class got that right. Well, obviously, I’ve got to touch on this a little bit more. And here, you can see that the majority got it wrong, so this I definitely need to talk about more. So, I can use it to actually better adjust my teaching... Instead of giving a paper-and-pencil vocab quiz, they could accomplish that exact same thing and use that. And now, you’ve just saved yourself all the time of grading.

Along with the convenient grading and collecting assessment results, a teacher further reported how the use of grading apps saved his time and effort to prepare documentation of his effectiveness.

PHS: They have this app [Socrative]. They do it, and then they send it to me, and then I can review it. So, that’s a review activity, but I actually have the evidence of that review activity, so that, because evidence collection is such a huge piece of teaching now... We have to be able to put quantifiable measures to student learning and assessment in general has been a big area of focus. But then also, personally, for our evaluations, the way our principals evaluate us, is based on smart goals.
that we create. You have to be able to quantify and demonstrate how that's being achieved. So, this is a good way to kill two birds with one stone. You're assessing the students. You're getting to see how they're doing, but then, you're also collecting evidence of that. So, if the question came up, how have you been able to teach the students how to graph one of your equations, I can say, well, this is how, and have it right there.

While some teachers illustrated the convenience of using iPads as grading and collecting data tool, some teachers reported the use of iPads as a communication tool.

BHS and LHS reported how they used a notification app, SchoolConnect. Using the app, they were able to send out messages “anytime, anywhere” and inform students about important assignment deadlines and school events.

BHS: SchoolConnect. It is a notification-maker, so what I can do is create a notification, like you know how Facebook has notifications if someone writes on your Wall, it sends you a 'Ding' on your phone? Well, this app allows you to do it towards the iPad or the iPhone, so what I do is, I put my name and then I write the assignment. It's a reminder. It gets rid of the whole "Oh, I didn't know we had homework last night". It gets rid of that excuse, because that goes right to their iPads. I can send a message to the whole class.

LHS: I'm a sponsor of Fun Club, an after school club. It is a social group I created so that my students can socialize more at our school. Since [students] get so much email, that they don't even read them... I use SchoolConnect² to send out my notification. Once you log in, if you're a student, you find your school and then you can find anything that's in there. They used to have to contact the main office, fill out a slip, and then, at the end of the day, the girl that just did the announcement, she would say "Fun Club will meet today from two to three". It's quick. You can get the word out.

² SchoolConnect is a one-way notification app that allows schools to inform and alert school messages safely and securely unlike open forums like texting, Facebook or Twitter. Schools can view a record of all push notifications sent by teachers, club sponsors and coaches for secure tracking.
Overall, teachers reported conveniences of using iPads to complete their diverse school tasks, such as distributing classroom materials, grading and collecting data for students and for teacher evaluations, and communicating with students. These teacher self-perceived conveniences positively influenced teacher use of iPads.

4.4.3 Reliable accessibility and immediacy of iPads

Another motivation factor that all participants reported is reliable accessibility and immediacy of iPads. Teachers explained the reason for disliking their previous computing tools, such as laptop carts and computer labs, demonstrating the importance of this motivation.

Before they had iPads, both schools had either computer labs or laptop carts that teachers could use to support their teaching. Because those labs and carts were shared by other teachers, they could not access those tools every time they needed and found difficulty in planning technology-based lessons. Because of the inconsistency and unreliable accessibility of those tools, teachers perceived it difficult to plan technology-based lessons with previous technologies. Reliable accessibility facilitated teacher use of the new tool.

The following three teachers expressed their frustration using laptop carts and computer labs, and explained reasons for preferring iPads.

AHE: I like to have iPads because we don’t have to sign out computer labs anymore. You don’t have to worry about there not being enough computers for your 36 students. You don’t have to worry about whether or not there’s going to be a broken computer. You always have access.

WHS: Before it was always on computers. The computers, you had to get the computer lab. You couldn’t be sure that that day somebody wasn’t in
there, like, another class wasn't in there. Then you had to match up the schedule. Then you had a snow day and you'd lose the next day we can't finish, and it could be two weeks before you get another shot at the computer lab. With the iPads you're guaranteed anytime you want to do it, whenever this material comes up. You're ready for it. You know the kids all have the resources available.

The above teachers elucidate how the reliable accessibility of iPads in the classroom influenced their preference of using iPads compared to the previous technologies.

One teacher further articulated how both the accessibility of iPads in the classroom and the immediacy of iPads increased his teaching time, influencing his use of iPads in teaching.

KMS: You could take them to computer lab, but then it gets into the whole transaction time. When we have to go to computer lab, students first come to my class, I gave them direction, they get settled in, "Ok now it is time to get up and go to computer lab." Transition is tough for middle school kids, transition to get settled back in, probably I have to give the direction another time, if not a THIRD. Then they have to log in, the login time takes forever. Now we were 10 minutes in the class, 12 minutes in the class, when we could share this lab.

KMS is not the only teacher who reported the benefits of the reliable accessibility and immediacy of iPads. Others also had similar experiences.

BME: The [computer] cart, if you could find it, was not always in the best condition. It was just too many people using it. So, you would sign it out one day. And then, you forgot to put it back. And then, I'm looking for it for my next class, and I can't find it. Or, it's not charged. Or, there are some that are broken, and no one reported it broken. It's just what happens, when you have a whole school using a couple of these carts. They just became a mess. So, this (iPad) is much better; faster, easier, instantly on, instant access.

BME: [Computer carts] took a long time to load. People wouldn't put it back properly. The things wouldn't be charged. It was kind of a nightmare.
MMS: Half laptops didn’t work. They took forever to load... That’s what makes a difference, the instant gratification of iPads. It’s a big deal. Having them instant access to what you are looking for, having kids turn it on and five seconds go, SO CRITICAL.

OME: The writing part of it, it was either gonna be the cart [the computer cart] or it was gonna be the iPad. So it was actually better to have the iPad. Because all they have to do is turn it on and plug in the keyboard. The cart, you had to power it up, they had to go into Google Docs, in 15 minutes of class, it took them a good 10 minutes just to get into the program they’re gonna use. Now it’s just matter of turning it on, clicking on Pages, and typing or, if it is reading, they just turn on the iPads, click on iBooks, and it’s right there. So it’s definitely much more efficient in terms of how I use it.

In general, both of the reliable accessibility and immediacy of iPads were mentioned as common motivation factors that teachers reported. Teacher reported that these characteristics of iPads increased their teaching time, compared to previous technologies and as a consequence increased their willingness to use iPads in the classroom.

4.4.4 Preparing students as digital learners in the 21st century

Some teachers also reported that preparing digital learners in the 21st century was another motivation factor to use iPads. In the section 4.2.2.2.2, teachers reported their knowledge of student weaknesses in using technology—lack of understanding of the use of technology for education, lack of discipline, and lack of patience. Based on this understanding, some teachers perceived that having the iPad served as an opportunity to develop (1) student skills to access, evaluate, create, and communicate information using technology and (2) student understanding of responsible use of technology. This motivation, preparing students as the digital learners, was illustrated in the following discussions.
PHS: It [iPad] is a good mechanism to teach responsibility, electronic responsibility. I have a phone right now and I could be playing a game while I'm talking to you, you know? But I'm not because it's not responsible, so, but like teaching that skill, you have to do it in an authentic situation. That's what I'm trying to do...we are teaching a greater skill, a larger skill and more that we do it, the better it prepares the students to move into a different world like that...So being able to use the different technologies, create Power Points, create visual medium, use the electronics that way. And I think all those are real career and life skills. That's always a motivating factor.

BHM: If we could shut off the games and the messaging, Perfect! But we also give them the technology, you don't want to take it all away from them. You want to teach them to be responsible with it. But they're teenagers. They're not responsible.

BHS: When they go to college, they're going to need, whether it's a tablet or a laptop, they're going to need that to do research, to do papers, to do everything, so why not get them going sooner? And that's the way jobs are.

BME: I think you want to start preparing them for what they're going to be asked to do as they get older, and then certainly out in the world, whatever job they might have. ... That's how they make things, using the computer, so the more practice we can give them with that [the betters]. Now, they're digital learners. This is how they are creating and accessing information, through a computer. I think it's not to say that kids still don't want to create things with paper and pencil, because I think they do, but when they need to create something to share with an audience, it's nice to have a tool that allows them to do that in a way that people can read it, it's easy to understand, put-together.

Two teachers further explained how they developed the students' skills to use technology for educational purpose to prepare them as the digital learners in the 21st century world.

THS: I'd say to a kid, "Okay, listen I don't want you to do anything just mirror it [iPad] up. I don't even care what's on there. Now show us how you found that document in all of the documents that you have." And that way they get a chance to see there are many different ways to store it, many different ways to retrieve that information. So it's not just about my particular content but it's about to use the technology because of the things that we're supposed to demonstrate, effective use of technology. That's in our mission.
WHS: They're tools in the trade of life they need to use. And the more they can learn how to use it for good things, the more options they have to use it in a better way. So that they might make that choice in a classroom say, “Maybe I should take a video of what this teacher is demonstrating with swinging balls on the table thing. Camera is an iPad. Maybe I should video tape this using iPads while I’ve got this here and then I can look at that when I go home and see why he thought that was such an important thing to do or maybe I'll remember it better.” Whereas if he was never suggested that we may take a picture of this, recording an experiment of something, just to think that the ability to like... I want them to use the technology [iPad]. I want them to find how many ways they can use the technology. I say, “you either have the best teaching, learning tool in your hand or you have the best $300 paperweight and messaging machine that you ever could imagine.”

PHS: Quite frankly with, since we've gotten the iPad, we've introduced the whole concept of 21st century skills. That's become more of a piece of it. A lot of the stuff that we do with 21st century skills you can't do without using 21st century technology. So those kind of things are in line. They are really tied together... You can't just prohibit it and say, “be responsible” and never give them the opportunity to try... You can't say don't use this [iPad and iPhone], you can't do that. It doesn't teach them. You need that to teach them. And the more they can learn how to use it for good things, the less they can, the more options they have to use it in a better way when they go to work.

THS, WHS, and PHS described their willingness to use iPads in the classroom to prepare the digital learners by guiding educational use of iPads in the classroom. Teachers reported that it is important to prepare students to become 21st century digital learners who can use technology responsibly for learning. Teachers regarded iPads as one of methods to achieve this aim, motivating them to use iPads in teaching.

4.4.5 Summary: Teacher self-reported motivation

The above reports summarize teacher self-reported motivation. Over all, teachers reported that their perceived benefits of using iPads in teaching motivated them to
integrate them into their teaching. There were four different teachers educational benefits: positive influence on student engagement, convenience, accessibility, and preparing digital learner.

### 4.5 Summary

This study aimed to report teacher self-perceived needs to use iPads in terms of knowledge, skills, and motivation based on interviews, classroom observations, and classroom documents. I was able to categorize those three concepts—knowledge, skills, and motivation (table 4).

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<th>Pedagogical Knowledge (PK)</th>
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<td>Understanding of Learner</td>
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<td>Understanding of Technology Integration as Trial and Error</td>
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<th>Pedagogical Skills (PS)</th>
<th>Skill to Evaluate Lessons, Teaching Resources, and Tools</th>
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<td>Skill to Individualize Instruction</td>
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<th>Technological Knowledge (TK)</th>
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<th>Technological Skills (TS)</th>
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<td>Skill to Transfer Digital Files into iPad Acceptable Formats</td>
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<td>Skill to File Share using Cloud Services</td>
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| Content Knowledge/Skills (CK/CS) | Assumed |

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<th>Motivation</th>
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<td>Preparing students as Digital Learners in 21st century</td>
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Table 4: Sixteen Elements of Knowledge, Skills, and Motivation in Using MT

Teacher self-perceived knowledge was categorized into three main themes: content, pedagogical, and technological knowledge. First, teacher content knowledge was
assumed to be sufficient based on their teaching experiences and the Massachusetts
teacher licensure regulations. Based on the interview data, classroom observations, and
classroom documents, pedagogical knowledge was categorized by three sub-themes:
understanding of goals, understanding of learners, and understanding of technology
integration as trial and error. The elements of technological knowledge related to the iPad
were reported based on interviews. All participants reported knowledge of technology,
particularly two elements: (1) understanding of iPad capabilities, and (2) understanding
of its limitation. Overall, participant experiences demonstrate that teachers relied on
content, pedagogical, and technological knowledge to utilize iPads in teaching.

Teacher skills were categorized into two main themes: pedagogical, and
technological skill. Based on the interview data, classroom observations, and classroom
documents, pedagogical skill was organized into four sub-themes: (1) skill to evaluate
lessons, teaching resources, and tools, (2) skill to individualized instructions, (3) skill to
manage classroom, and (4) skill to relinquish. To determine teacher self-perceived
technological skills, I selected a teacher who reported his developmental process of
technological skills in using iPads in teaching, and interpreted from that teacher’s self-
reported experiences those skills perceived to be necessary. Also, I examined my
classroom observation notes and documents from other participants to enhance the
reliability of the skills identified by one teacher. Based on the data, my analysis found
three sub-themes related to technological knowledge: (1) skill to modify digital
documents, (2) skill to transfer digital files into iPad acceptable formats, and (3) skill to
file share using cloud services. The participant discussions, in general, show that teachers
applied both technological and pedagogical skills when they used iPads in teaching.

Teachers reported four different motivation factors in using iPads: (1) perceived student engagement, (2) convenience, (3) reliable accessibility and immediacy of iPads, and (4) preparing students as 21st century digital learners. All participants expressed diverse benefits of using iPads. Their self-perceived benefits of using iPad in teaching and learning increased their willingness to use iPads for students learning.

The following chapter is a discussion of the findings and the research questions, the implications of the results of this study, and recommendations for future research.
CHAPTER 5

5 Discussion

The purpose of this study was to report teacher self-perceived knowledge, skills, and motivation for using mobile technology (MT). In this study, MT refers to portable computing devices, such as iPhones and iPads that combine web and multimedia capabilities, and communication services. See 2.1 for further clarification of the definition of MT.

The overarching research question was: which factors, related to knowledge, skills, and motivation do teachers report as influential when using MT? The detailed questions that guided this study are as follows:

- What components of knowledge do teachers think they need to use iPads?
- What skills do teachers think they need to use iPads?
- What motivates teachers to integrate iPads in the classroom?

At its inception, this study separated the overarching research question into three sub-questions based on the anticipation that teachers would perceive their knowledge, skills, and motivation as separate elements; however the data in this study revealed this assumption to be inaccurate. Participating teachers’ knowledge, skills, and motivation were intertwined and evoked holistically when they planned their lessons according to the potential usefulness of iPads in the classroom. When I asked a question regarding a concept, for example “motivation,” they often also incorporated “knowledge” and skills” into their response. Perhaps this is because when teachers design their lessons with
technology, such as MT, teachers rely on knowledge, skills, and motivation to create lessons while integrating iPads in curricula.

To describe that these participants experienced the elements of skills, knowledge, and motivation as intertwined, Section 5.1 discusses how they applied those elements to develop lessons by using iPads to achieve instructional goals. While drawing attention to the intertwined relationship of those elements among the participants, this study also yields suggestions regarding the content of MT integration training. I include interview data additional to that reported in chapter 4 to support my arguments through teacher voice.

Section 5.2 presents a discussion of the implications of its findings as well as their relationship to previous literature. This section first confirms the understanding related to the importance of teacher knowledge, skills, and motivation in the field of educational media and technology by discussing participants’ needs of skills, knowledge, and motivation when integrating iPads. Second, based on the understanding of teachers linked view of skills, knowledge and motivation gained from section 5.1, I propose to refine the TPACK model as a web diagram, rather than a Venn diagram to more accurately illustrate the teacher view of TPACK relates to teacher expressed needs.

There were six elements of knowledge, skills, motivation that these participants employed in the overall iPad integration process, rather than using them individually to specifically achieve their instructional goal. Section 5.3 discusses these basic elements that were not discussed in section 5.1. Lastly, chapter 5 closes with a discussion of the limitations of and recommendation for this study.
5.1 Holistic View of Teacher Knowledge, Skills, and Motivation

The purpose of this section is to discuss participants' intertwined elements of knowledge, skills, and motivation that are linked to three specific instructional goals identified in this research: *deepening learner knowledge, creating constructive learning,* and *developing independent learners* (see 4.2.2.1). As described earlier, these teachers reported that the understanding and defining of their instructional goals is the initial step to integrating iPads into teaching; thus to discuss the interrelationships of elements, it would be logical to start with the initial step that teachers reported. For each goal, I discuss the process these teachers followed to emphasize that they experience the elements as interrelated to serve specific goals. Through this analysis, this section also provides suggestions regarding the content and strategies of MT training.

5.1.1 Integrated elements to deepen learner knowledge

Deepening student knowledge describes an aim of participating teachers through supplementing their traditional teaching resources, such as textbooks and worksheets, with online resources. In order to *deepen student knowledge*, the participating teachers explained their process, which included four, primary, intertwined knowledge and skills: *understanding of learner differences, evaluation skill, technological skills,* and *technological knowledge.* Of particular interest here is that these teacher self-reported experiences and explanations highlight that this goal involves multiple, linked elements.

The teachers demonstrated that *deepening learner knowledge* involved *understanding of learner differences,* for example previous knowledge and learning strengths and preferences (see 4.2.2.2.1). Based on this understanding, they seek out and
used various resources to better support different student learning needs and styles, such as providing different levels of content and diverse material formats, such as text, audio, and visuals. Also, by searching and studying examples of real-life applications of subjects with students, these teachers participating teachers made connections between subject matter and real-life contexts to stimulate student interest in learning and to help them achieve meaningful learning.

To determine useful resources to supplement traditional classroom materials, the participating teachers first needed to evaluate previously used teaching resources (see 4.3.2.1). Using these skills, they determined what information they wanted to add or exclude to create more effective materials. Then, these teachers utilized technological knowledge to include supplementary resources that students can use on their iPads. The understanding of iPad capabilities, such as app attributes, wi-fi capability, and web-browsing feature, helped them to revise their resources specifically, but also their overall lessons broadly, in creative and innovative ways. The understanding of the iPad limitations, such as the inability to run Flash, enabled them teachers to select acceptable online resources to supplement traditional resources (see 4.2.3).

To complete the process, these participants needed to several necessary technological skills. They needed to: modify digital documents, transfer digital files into iPad acceptable formats, and share files using cloud services. These digital literacy skills enabled the teachers to flexibly modify lesson resources, and share them online, so that students could access them “anytime, anywhere” via iPads. Lack of these technological skills challenges the integration process. Three participants act as illustrative examples of
the importance of these interrelated components of iPad integration. THS reported a lack of technological skills (see 4.3.3.1), which halted the iPad integration process in his first year of his school iPad implementation project. THS then sought out technological skills development to increase iPad integration more successfully in the second year. On the other hand, two teachers, LHS and WHS, had yet to develop sufficient skills and thus relied on either coworkers or students to incorporate iPads in teaching (see 4.2.2.2.2).

To achieve the instructional goal of deepening student understanding, the participating teachers relied on weaving together their skills and knowledge. Therefore, educational stakeholders need to be aware that integration of MT, such as iPads, in teaching requires, first and foremost, training that should begin with educational goals, such as deepening student understanding. Then training should focus on developing specific skills and knowledge that support the instructional objective, such as skill to evaluate, understanding of MT capabilities and limitations, skill to modify digital materials, skill to transfer to technology specific formats, and skill to share using cloud services. Focusing on these specific skills in teacher training will very likely improve their productivity with iPad and similar technology.

5.1.2 Integrated elements to create constructive learning environment

Participating teachers described the goal of creating a constructive learning environment. When participants had both understanding of iPad capabilities and perceived student engagement when using iPads, these teachers were willing to integrate iPads to create these environments, requiring various iPad apps, internet access, videos, and sound.
To understand the interrelated skills and knowledge that these teachers relied on to achieve this instructional goal, it is first necessary to understand the goal itself (see 2.3.4.1.4). As the literature defines it, constructive learning is building new knowledge through exploration, inquiry, and testing in authentic contexts (Cooperstein, & Kocevar-Weidinger, 2004; see 2.3.4.1.4). To create a more active learning process through the use of iPads, teachers were motivated by student engagement (see 4.4.1). They believed that when students are more engaged in learning, students will be more motivated to pay attention, work harder, and push themselves to excel. As these teachers understood it, this positive learning attitude helps students to integrate, transfer, and retain new knowledge better. For example, MMS expressed this instructional belief.

*The boy who looked up the ring worm on his iPad will probably tell his folks about it tonight. He's going to share that experience, because he went out of his way to find that picture and to find if that was virus or bacteria. Those are their mini-experiences that are different from the norm. They will pick up on those more. The more fun a child has with an assignment, the more likely they will remember it...In senior year they'll be like 'Remember the day when we went to outside, we were jumping around leaves and had a lot of fun.' That's what they remember. So, you have to give them those experiences.*

MMS's perception was shared by all participants, suggesting that this motivation factor, student engagement, strongly related to creating constructive learning environments.

When designing constructive learning with iPads, these teachers also applied skill to individualize instruction to ensure students understand the task basics together and get the necessary individual support so they understand that the learning goals are attainable. Related to individualize instruction is knowledge of learner differences. Arguably, no teacher can have the skill to create individualized instruction for a specific learner
without knowledge of that learner’s difference. These participating teachers understood that each student has different backgrounds, strengths, and weaknesses (see 4.2.2.2.1), and so knew that students will encounter different learning challenges using iPads.

One example of the use of both knowledge of learner difference and skill to individualize instruction to create constructive learning environment was THS’s experience (for additional teacher experiences, see 4.3.2.2). When he assigned a project-based lesson requiring students to use iPads, he had students start their projects in the classroom to explain and confirm the use of technology for the project and to compensate for different student capabilities; thus he specifically tailored his instruction to student needs to help overcome these. In response to a question about the integration of iPads, THS provided an example:

*I always like the kids to start iPad projects in class in case they have questions. Some kids still don’t even know how to change the color of a font yet... But if I have two kids that didn’t know what was going on, that’s when I want to be able to give them step 1, step 2, and step 3. ‘Do those three steps, try the forth and fifth steps which you can do. I will be back to you.’*

In sum, to achieve the instructional goal of creating a constructive learning environment, these participating teachers employed two intertwined elements of skills and knowledge: individualize instruction and understanding learner differences. Based on understanding of these teachers’ self-reported process of iPad integration in teaching, educational stakeholders should be aware that effective training should begin with an instructional goal, such as creating constructive learning environment, and then develop the necessary related skills and knowledge to achieve that goal. In addition, illustrating educational benefits of using MT, such as increased student engagement, is likely to
foster their motivation to begin using MT. This research supports the conclusion that the integration of motivation, skills and knowledge should be a focus of training for the purposes of technology integration.

5.1.3 Integrated elements to develop independent learners

Participating teachers aimed to develop independent learners by being a “guide on the side” rather than “sage on the stage” and facilitating learning in less directed way. They wanted students to become independent from teachers and so they can drive their own learning and move learning forward on their own. These teachers’ reason for this goal is illustrated by BHM (for additional teacher opinions, see 4.2.2.1.3):

*I think it's up to us teachers to create students that will learn on their own, to become independent learners, because if they're an independent learner they don't need me. They can do it on their own. That's what we want. We want them to be able to survive, move forward, and progress on their own.*

These participating teachers’ experiences in developing independent learners were linked to two elements of knowledge and a skill: technological knowledge—iPad capability—and skill to relinquish. To allow students to explore and select their own preferred learning tools, these participants knew that they needed to provide diverse tool options. Because participants understood the diverse options available in the iPad, referenced to iPad capabilities, these teachers created situations in which learners could explore and discuss apps, to complete a task, and also to develop critical thinking skills. Furthermore, while allowing students to select their own preferred learning tools, they were able to help students build understanding of their own learning strengths and preferences, and enabled students to design their own effective study strategies.
To add flexibility in the activity of teaching, these teachers also relied on *skill to relinquish* (see 4.3.2.4). They knew that there was a vast amount of apps that students can download and use. Thus, it is difficult for them to master all iPad apps and be ready to answer all technological questions. By relinquishing the teacher role as the primary source of knowledge, particularly related to iPads, these teachers were able to allow themselves to collaborate with students to learn about iPad capabilities to support teaching and learning. Also, this *skill to relinquish* allowed them to make mistakes using iPads in the classroom and overcome the fear of failure using iPads. These teachers perceived students as “partners” who provide technological support in the classroom and who help teachers to develop their own technological skills and knowledge (Prensky, 2010).

Just like previous examples—*deepening learner knowledge and creating constructive learning*—two intertwined elements of skill and knowledge were again linked to these teachers experiences in *developing independent learner*. To prepare teachers with adequate skills and knowledge, training should begin with an instructional goal—*developing independent learner*—, and then, encourage development of specific skills and knowledge, such as teacher’s *skill to relinquish* and *understanding of MT capabilities*.

Hence, educational stakeholders need to be aware that teacher preparation programs that solely focus on developing one of these elements do not benefit MT integration in curriculum. The most important finding of this study is that teachers perceive knowledge, skills, and motivation as intertwined concepts that were
simultaneously and continuously applied to integrate MT in lessons. Based on my understanding, I describe technology integration as a domino-effect, with skills and knowledge as different pieces to set up the lesson, and with motivation as the catalyst for the process. Thus, preparing teachers to have all the elements is crucial. Based on their skills, knowledge, classroom experiences, teachers should be able to position MT, specifically here the iPad, flexibly to create interesting and innovative lessons.

The above discussion examined how participating teachers’ knowledge, skills, and motivation were intertwined and evoked holistically when they planned their lessons according to the potential usefulness of iPads in the classroom. The next section discusses the importance of participating teachers’ knowledge, skills, and motivation by reflecting on the history of educational media and technology. Also, a refined model of TPACK, a web-diagram, is proposed to accurately illustrate participating teachers’ intertwined view of knowledge and skills in the iPad integration process.

5.2 Grounding Findings of this Study and Literature Review

The purpose of this section is to reflect and extend the current understanding of teacher knowledge, skills, and motivation related to educational technology based on the participating teacher perceptions of those three concepts when using iPads. This section discusses a single similarity and a single difference between this research findings and the literature review. The similarity found was the importance of teacher skill, knowledge, and motivation when integrating technology in the classroom. The difference found was that participating teachers discuss the elements of TPACK as an intertwined rather than an overlapped model. “Teachers intertwined view of TPACK” means that
teacher perceived that TPACK's elements are holistically intertwined rather than separately grouped as discussed above.

5.2.1 Importance of teacher knowledge, skills, and motivation

Previous research reported the benefits of using technology in education. However, the history of educational technology has proven when teachers are not prepared with adequate skills and knowledge to use technology, or motivated, teacher use of technology in the classroom is limited and infrequent (Clark, 1994; Coppola, 2004; Cox & Graham, 2009; Cuban, 1986; Hruskocy, Cennamo, Ertmer, & Johnson, 2000; Mumtaz, 2000; Saettler, 1990; Williams, Coles, Wilson, Richardson, & Tuson, 2000). This overall notion is confirmed from the data in this study. The participating teachers explained that it was necessary for them to utilize their pedagogical knowledge and skills to integrate the use of iPads into their previous lessons. For example, knowledge of instructional goals along with evaluation skill enabled them to analyze the existing lessons, identify the educational role of iPads, and implement iPads into curriculum to facilitate teaching and learning. The importance of teacher understanding of instructional goals as an initial step in the technology integration process is consistent with previous studies. For example, Ogle, et al. (2002) explained that "It is important that integration be routine, seamless, and both efficient and effective in supporting school goals and purposes... Integrating technology is what comes next after making the technology available and accessible. It is a goal-in-process, not an end state" (Ogle, et al., 2002).

The literature has shown that a technology added to an existing curriculum without careful integration has only a marginal effect and emphasizes the need for
systematic instructional design of the implementation process (Coppola, 2004; Dockterman, 1989a; Dockterman, 1989b; Saettler, 1990; see 2.2.3). For example, Saettler (1990) emphasized the need for systematic instructional design and the implementation process to maximize the benefit of using technology for education in stating that "...it is now known that technologies do not mediate learning, but that knowledge is mediated by the cognitive process produced by technologies. Consequently, the function of educational technology involves the development of powerful instructional designs that generate the most productive cognitive processes required for particular learning tasks" (Saettler, 1990, p. 453). Thus, educational stakeholders should understand that meaningful technology integration in curricula should align with teacher pedagogical knowledge and skills.

In addition to identifying the necessity of the participating teachers' pedagogical skills and knowledge to effective integration of iPads, participants also described the technological knowledge and skills they needed for the iPad integration. For example, these participants' understanding of iPad limitations—that Flash does not work, for example—helped them select appropriate online resources that can be used by students. Also, by using technological skills, such as skill to modify, transfer, and share iPad acceptable digital files online, these teachers were able to flexibly revise their previous teaching materials and supplement existing educational resources to deepen student understanding of content. The importance of teachers' technological knowledge and skills is also mentioned by previous research (Mishra & Koehler, 2006; International Society for Technology in Education (ISTE), 2008; Graham, Burgoyne, Cantrell, Smith,
The literature argues that teachers are the ones who best understand their students, classroom environment, and the overall school context. Teachers are the one who manage and create learning resources to teach and to support their student different learning needs. Thus, with the evidence from this study, I contend that it is necessary to develop teacher technological knowledge and skills to enable teachers to create, modify, and distribute classroom content on MT. In doing so, teachers will be able to use MT more flexibly and broadly supportive in their lesson activities.

Reflecting upon participating teachers’ reasons for using iPads, motivation is another important element to achieve meaningful adoption of iPads. The participants’ experiences revealed that their perceived, specific, educational benefits of using iPads was a primary motivation factor. The importance of this motivation factor is explained by comparing two participants’ experiences. OME was reluctant to use the iPad in the beginning because of her lack of involvement in selecting it as a classroom tool. However, after she realized that using the iPad in the lesson activities increased student engagement and excitement, she changed her perspective and was willing to use iPad in the classroom. Also, after she realized that using iBook motivates students to search for the meaning of new words and so increases their vocabulary, she preferred to use iBook rather than textbooks. On the other hand, LHS reported that students’ dislike of an educational app demotivated her use of iPads. She thought IXL, a mathematics app, was a great tool to reinforce her students’ mathematic skills. However, after she perceived her students’ negative learning attitude in using the app, she stopped using it. By examining
these teachers’ experiences, encouraging teachers to integrate MT requires informing
them of the specific instructional benefits of MT. Previous studies also have shown
similar results indicating the importance informing teachers about the educational value
of a new tool (Cuban, 1986; Saettler, 1990; see 2.2.1 & 2.2.2). When teachers did not
understand the benefit of using film and ETV, they could not define the educational
purpose of a tool and were less motivated to integrate it into their curricula. Thus, along
with preparing teachers with pedagogical and technological knowledge and skills,
educational stakeholders also need to introduce convincing educational benefits of MT to
involve teachers in integration to innovate through MT.

The teachers who participated in this study clearly indicated that the utilization of
their knowledge, skills and motivation in the iPad integration process was essential. This
finding confirms and is consistent with previous research through the history of
educational media and technology (Coppola, 2004; Cuban, 1986; Dockterman, 1989;
Saettler, 1990; Zhao & Conway, 2001; see 2.2).

5.2.2 TPACK model suggested refinement

The purpose of this section is to discuss a refinement of the TPACK model to
more accurately illustrate the participating teachers’ intertwined view of skills and
knowledge rather than its overlapped relationship that the current TPACK model
presents.

TPACK is a framework illustrating teacher knowledge related to technology
integration (figure 4). It consists of seven elements of knowledge: three fundamental
types of knowledge and four intersecting domains (see 2.4). The three fundamental types
of knowledge are pedagogical knowledge (PK), content knowledge (CK), and technology knowledge (TK). The four-intersecting sources of knowledge are pedagogical technological knowledge (PTK), technological content knowledge (TCK), pedagogical content knowledge (PCK), and technology pedagogical content knowledge (TPACK). According to Mishra and Koehler (2008), teachers with TPACK can combine and employ those elements of knowledge competently to enhance their curricula through integration of technology (see 2.4). According to this framework, knowledge also includes skills.

![Figure 4: Technological Pedagogical Content Knowledge and its Elements](image)

However, this study distinguishes these two separate elements, for example, technological knowledge as TK and technological skill as TS as guided by the research questions. Technological knowledge is of the iPad capabilities and limitations and technological skill is concerned with file and resource management.

This present study identified technological, pedagogical, and content knowledge and skills related to the integration of iPads. These twelve elements are presented in Table 5.
Pedagogical Knowledge (PK) | Understanding of Instructional Goals
Understanding of Learner
Understanding of Technology Integration as Trial and Error

Pedagogical Skills (PS) | Skill to Evaluate Lessons, Teaching resources, and Tools
Skill to Individualize Instruction
Skill to Manage Appropriate iPad Use
Skill to Relinquish

Technological knowledge (TK) | Understanding of iPad Capability
Understanding of iPad Limitation

Technological Skills (TS) | Skill to Modify Digital Documents
Skill to Transfer Digital Files into iPad Acceptable Formats
Skill to File Share using Cloud Services.

Content Knowledge and Skills (CK/CS) | Assumed

| Table 5: Twelve Elements Skills and Knowledge in Using MT |

As discussed in section 5.1, the main finding of this study is that participating teachers discussed their relationship of skills and knowledge as intertwined, parts of a larger whole that describes teaching. They simultaneously applied those elements to complete the process of designing lessons using iPads. Based upon a shared participant view on instructional goals as an initial step for iPads integration and the intertwined relationship of TPACK elements, I suggest to refine the current TPACK model as a “web” diagram, rather than a Venn diagram. This proposed “web” diagram demonstrates links between the teachers’ elements of skills, knowledge and their own instructional goals. Figure 5 is a functional model that refined TPACK. It is an example of a particular teacher’s interrelated skills and knowledge that are related to an instructional goal (figure 5). The size of circles and lines will be different depending on each teacher’s experiences, skills, and knowledge.
The proposed "web" diagram also includes motivation. As explained above (see 5.2.1), the history of educational media and technology has repeatedly found that motivation is an important factor in the technology integration process. Thus, adding motivation to the model expanding the current TPACK framework is important. This holistic view of TPACK and motivation allows educational stakeholders to gain a better understanding of teacher needs for MT integration so they can design MT training that will most effectively support teachers' needs.

![Diagram of TPACK as a "Web" diagram]

Figure 5: The Refinement Model of TPACK as a "Web" diagram

5.3 Basic Elements of Knowledge, Skill, and Motivation

There were six elements that participating teachers employed to the overall iPad integration process rather than to achieve specific instructional goals (table 6). The purpose of this section is to discuss the importance of the basic skills, knowledge, motivation that was not discussed in section 5.1 and to make suggestion for developing them.
Table 6: Basic Elements of Knowledge, Skills, and Motivation in Using MT

<table>
<thead>
<tr>
<th>Pedagogical Knowledge (PK)</th>
<th>Understanding of Technology Integration as Trial and Error</th>
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<tbody>
<tr>
<td>Pedagogical Skills (PS)</td>
<td>Skill to Manage Appropriate iPad Use</td>
</tr>
<tr>
<td>Motivation</td>
<td>Convenience</td>
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<td></td>
<td>Reliable accessibility</td>
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<td></td>
<td>Immediacy of iPads</td>
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<tr>
<td></td>
<td>Preparing students as Digital Learners in 21st century</td>
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</tbody>
</table>

5.3.1 **Skill to manage appropriate iPad use**

Previous studies reported that classroom distraction is a significant issue when using MT in the classroom (Campbell, 2006; End, Worthman, Mathews, & Wetterau, 2009; Gingerich, 2011; see 2.3.4.2). The participating teachers also reported these challenges. They said that iPads have created different types of behavioral problems among students, requiring teachers to develop different types of classroom management skills than those ordinarily demanded when iPads were not in use in the classroom.

To explain the need of different types of management skills, these participants elucidated three new types of behavior problems. First, there are many non-educational apps, such as games and message services that students can download and use for entertainment and social purposes. Students can be easily distracted by these apps, which makes it difficult for teachers to maintain students’ focus on learning activities. In addition, because iPads are not designed for educational purposes, but for personal use, it is difficult to manipulate the platform and force students to use iPads only for educational purposes. The following examples explicated these teachers’ opinions on different types of behavior problems and the need of different types of classroom management strategy. One teacher noted:
Different types of behavior problems. Different types of classroom management skills. I wouldn't say that it's more because there are some things that are less. You don't have as many students talking out because they're more interested in trying to sneak onto Instagram or Flappy Bird or whatever the app of the day is. So, you don't have that so much anymore, but you definitely have more monitoring to make sure they're not on Flappy Bird or Instagram. It's different.” Another teacher further explained: “it's a different type [of classroom management skills]. Students are not perfect. They will be off-task some days. They have good days, they have bad days, they have assignments they don’t like, assignments they like, subjects they like, subjects they don't like. Before, if they were off-task, they didn't have an iPad to entertain them, so they might poke the kid in front of them or throw paper across the room or draw something on the desk. You don't have as much of that happening now because there's something to entertain them. So, it's a different type of management.

Second, student technological strength also challenges classroom management. Some participants mentioned that student technological competence helped them develop their own technological skills. However, when it comes down to classroom management issues, student technological competence makes it more difficult for teachers to monitor student “iBad” behavior. Two teachers explained why student technological competence is a problem. THS said:

*It only takes a second for them to flip back to playing a game. You’re on that side of the room. This side of the room is playing games. You get back on here, that side of the room is [playing games]” OME further described this challenge, “When they are on their iPads, these kids are so savvy. They know how to sweep, you know what I mean. When you are walking by they are typing, you don’t really know if there are closing and opening up another app when you walk by, you know when you come back up here. So, it's very hard to manage a large class to know that they are using iPads appropriately. It’s not easy to manage.*

Lastly, participants said that there is no ideal punishment that they could apply to discipline their students’ “iBad” behavior. Their schools suggested that these teachers could give detention or take iPads away to punish students’ misuse of iPads. However,
these teachers explained these solutions were not effective. The punishment, such as detention, disengaged students from the learning activities, which did not benefit their teaching. When they took away iPads, students could not complete their learning tasks because most of instructional materials and activities were on iPads. This dilemma is well described by the following teachers. BHS said:

"...the iPad if you find that they are on Twitter or Facebook when they're not supposed to be, it's a different situation. Because if I take the iPad I have to get them a textbook, get the worksheet that we may be working on. So do I want to do that? Do I take it away? Do I not take it away? That's different."

WHS further explained why school’s classroom management suggestion does not work.

"We had a discussion about this, ‘Are we going to be sending every kid to the office? Taking away the iPads every time they do this’... Let's say I started last year, sending kids with their iPads down, or piling them up front or sending references writing out detention slips or detentions for everything that's all I'd be doing. There'd be no instruction at all... when you take it away now you no longer can do the project... homework assignments are on the iPad, notes, you know, it defeats the whole purpose too."

To manage “iBad” behavior, these participants applied the communication method: defined in chapter four as “straight-forward and joking” (see 4.3.2.3). They applied straight-forward communication method to explain classroom rules, expectation, and consequences of “iBad” behavior. By strategically joking with students, these teachers were able to return student attention to learning activities quickly, keep the classroom environment positive, and continue their instruction. Reflecting upon these participant experiences in identifying an effective “iBad” management method, teacher classroom experience was to be found crucial to the process of identifying practical solutions in managing “iBad” behavior.
To summarize, the participants articulated that using the iPad created different classroom behavior problems, requiring teachers to develop different classroom management skills. A common management method for helping these teachers discipline "iBad" behavior was to clearly communicate with students about rules, expectations, and the consequences of "iBad" behavior that were developed through their classroom experiences using iPads. Thus, to prepare teachers with adequate "iBad" discipline skills, educational stakeholders could utilize the teachers' expertise and wisdom gained in using iPads with students reported in this study to contribute to developing "iBad" management guidelines. These guidelines will help teachers who are just beginning to use MT understand the potential challenges, apply the appropriate solutions that match to their instructional styles, and create safe educational environments.

5.3.2 Understanding of technology integration as trial and error

All participants reported their understanding of technology integration process as trial and error as a common sense for the iPad integration process. This notion helped them overcome the fear of failure in implementing new lesson ideas using iPads, freed them to try using the iPad to support teaching, and helped them gradually integrate iPads throughout their curricula. The following discussion is an example that explains these participating teachers' understanding of technology integration as trial and error (for further example see 4.2.2.3).

Basically everything is just a trial and error. Just start very small, start with just a couple of things, try certain lessons that you already have, and then try to see, 'All right how can I incorporate the iPad into this lesson?'... So, I think that, just over time, you have more experience and you have more opportunities to try different things. So, I think it's just
time with the device and new applications that are coming out that are available.

These motivated participants were able to implement different iPad integration strategies and lesson activities with their students. Their experiences provided opportunities to see their own technology ideas in the context of their own classrooms. By reflecting on the successes or failures of their implementation, they were able to evaluate, revise their lessons, and try again to identify the use of iPads that they felt helpful and appropriate.

These accumulated experiences enabled them to build their confidence using iPads, explore more innovative ideas, and gradually integrate the tool in teaching. For example, BMS demonstrated how her understanding of trial and error allowed her to improve her lesson using the iPad.

The first class I did it with [iPads], it was a nightmare ... I got to see who my problem solvers were. I got to see who the kids were that gave up. I get to see who the kids were that said, 'I'm not sure how you do this. I know how to do this problem but I can't get it on.' I saw all the different kids...Then, when I had the next class come in, I said, 'This is how I'm going to do it differently.' I said, 'I'm going to do a balance. I'm going to give them the paper. Have them answer the questions and now, have them learn the tool [iPad]...' They felt comfortable...It's just this whole process of just seeing how kids work and what stresses them out. I started with the book and an iPad and then I tried the hybrid. I think it's just a lot of trial and error.

In sum, these teacher's self-reports suggest that understanding of technology integration as trial and error is a basic knowledge that impacts their willingness to try something new and different like the iPad and improve the quality of their adoption. This awareness enabled them to patiently try and then adapt iPads successfully into their lessons. Thus, educational stakeholders should be aware that developing teacher understanding of diverse problem solving processes, such as trial and error, is necessary
for MT integration. This understanding will catalyze a teacher’s willingness to put effort to learn related skills using MT to achieve instructional goals.

5.3.3 Basic motivation elements

This section discusses basic motivation factors that influenced these participating teachers’ willingness to engage in the overall iPad integration process. All participating teachers described that their willingness to integrate the iPad because of its *convenience, reliable accessibility, and immediacy*. Also, they perceived the iPad as a tool that they could use to instruct students in digital literacy skills and digital responsibility to prepare them as digital learners.

The *convenience* of iPad was one motivation. Using iPads, these teachers were able to simply upload and share classroom documents online with students at their convenience. In addition, teachers could be assured that students had permanent access to those resources and study "*anytime, anywhere*". This "*anytime, anywhere*" learning benefit of MT was also reported in the previous research (Cobcroft, Towers, Smith, & Bruns, 2006; Kinshuk & Chen, 2005; Pietrzyk, Semich, Graham, & Cellante, 2011; see 2.3.4.1.1). They did not need to make copies of documents, which save both teaching preparation time as well as paper. Also, using quiz apps like Socrative, teachers were able to not only save time grading, but also were able to collect assessment results conveniently (see 4.4.2). This assessment helped these teachers observe student progress, which helped them to modify the next day’s instruction.

The *immediacy* of the iPad was another factor that influenced teacher preference for using iPads instead of laptops. Students can quickly open and close iPads, which
saved time booting up computers and enabled teachers to use classroom time more
efficiently. One teacher expressed the iPad’s appeal for her in terms of this motivation: “I
didn’t really like using the Netbooks... the smaller computers It took so long to boot
up... so switching over to the iPad has felt good.”

The reliable accessibility of iPads was another factors that influenced teachers’
willfulness to design lessons with iPads. Before they had iPads, these teachers had laptop
carts or computer labs. Because those labs and carts were shared by other teachers, they
could not access those tools every time they needed and encountered difficulties in
planning technology-based lessons. This unreliable accessibility demotivated them to put
effort and time into initiating technology-based projects. For example, WHS’s reason for
using pencil and paper for his tree poster project before they had iPads explains the
importance of these motivational elements.

_They would do a poster of ten trees... they would draw it... I mean we
could do them [poster projects] before [iPads], but it was always on
computers. And the computers, you had to get the computer lab. You
couldn’t be sure that that day somebody wasn’t in there, like, another
class wasn’t in there, so you had to find two days. Then you had to look
ahead, had to match up the schedule, it was very difficult to get the two
days. Then you had a snow day and you’d lose the next day we can’t
finish, and it could be two weeks before you get another shot at the
computer lab. With the iPads you’re guaranteed anytime you want to do
it, whenever this material comes up. You’re ready for it. You know the
kids all have the resources available._

Lastly, participating teachers perceived the iPads as an educational tool to
improve student digital literacy and digital responsibility. By requiring students to use
diverse apps to develop school projects, these teachers wanted to develop their students’
basic digital literacy skills to find evaluate, create, and communicate information; these
skills would, in turn better, prepare them for the demands of college and their careers. More importantly, while monitoring and guiding student “iBad” behaviors, they wanted to develop students’ skill to self-discipline and their responsible use of MT, such as iPads, to prepare them as digital learners (see 4.4.4).

Overall, the participating teachers reported that their intention of preparing students as digital learners influenced their perception of using iPads to develop technological skills along with their subject matter and reinforced the value of integrating iPads in learning activities. Furthermore, *convenience, reliable accessibility, and immediacy of* iPads encouraged their willingness to initiate and increase the use of iPads in their curricula. Therefore, educational stakeholders should be aware that maintaining these benefits of MT—*convenience, reliable accessibility, and immediacy of* iPads—is crucial. Putting iPads in carts will diminish the aforementioned benefits of MT and make their use more cumbersome—similar to how teachers previously kept laptops in carts—and thus negatively influence teacher interest in using MT in teaching. Additionally, introducing a supplementary educational goal like *preparing digital learners* that can be achieved by using MT will contribute to a teacher’s perception of its capabilities and may foster their willingness to integrate MT into their curriculum.

The teachers’ basic skill, knowledge, and motivation described in this study were employed daily in using iPads. However, the data showed that these led to higher-level uses. The next section discusses participants intertwined elements of knowledge, skills, and motivation that are linked to three specific instructional goals identified in this
research: *deepening learner knowledge, creating constructive learning, and developing independent learners.*

### 5.4 Limitation and Recommendation for Future Study

To sufficiently observe my participants to collect rich information, I chose schools in Massachusetts, where I live. Thus, although my participants were state licensed teachers, these findings are limited to this group that share the same characteristics. More research is needed to generalize these findings to the broader community.

I limited my participants to those who had already used iPads in teaching at least for one year. My assumption was that teachers who used iPads for educational purposes for at least one year would have a deeper insight of using iPads and could make more valuable suggestions relation to knowledge, skills, and motivation for MT integration. While interviewing my participants and learning of their past reluctance to use iPads and the reasons, I was able to gain a deeper understanding of their needs, in terms of knowledge, skills, and motivation. For example, OME were reluctant to use iPads in the beginning. However, she changed her perspective after she realized that iPads enhance students’ engagement in learning. Thus, future studies should examine teachers’ reluctance to use MT to understand their needs, which should then be compared to experienced teacher needs.

This study pointed out several skills, knowledge and motivation to integrate iPads. Other researchers can replicate similar study using the same method but with
different subjects to determine and to expand the list of teachers needs, in terms of knowledge, skills, and motivation.

Based on participating teacher experiences, this study refines the current TPACK framework and proposes a functional model of TPACK that is dynamic depending on a teacher's experiences skills, knowledge, and motivation. A suggestion for future research is to develop an assessment instrument that is used to measure teacher training needs-gap, in terms of skills, knowledge, and motivation when using MT. Through the result of the needs assessments, educational stakeholders will be able to design tailored and more focused training to prepare teachers to integrate MT to support their teaching and learning.

5.5 Summary

There are two important findings of this study: (1) sixteen elements of skills, knowledge, and motivation when integrating iPads in teaching, and (2) teachers intertwined perception among these elements as related to their to instructional goals.

First, based on participating teachers' self-reported experiences using iPad in teaching, this study found sixteen elements related to knowledge, skills, and motivation that improved their ability to teach with iPads. In terms of pedagogy, this study identified three elements of pedagogical knowledge, and four pedagogical skills. In terms of technology, this study found two elements of technological knowledge, and three technological skills. In terms of motivation, this study identified motivations that encouraged teachers to integrate MT in teaching. These are shown in Table 7.
| Pedagogical Knowledge (PK) | Understanding of Instructional Goals  
| | Understanding of Learner  
| | Understanding of Technology Integration as Trial and Error  
| Pedagogical Skills (PS) | Skill to Evaluate Lessons, Teaching resources, and Tools  
| | Skill to Individualize Instruction  
| | Skill to Manage Appropriate iPad Use  
| | Skill to Relinquish  
| Technological Knowledge (TK) | Understanding of iPad Capability  
| | Understanding of iPad Limitation  
| Technological Skills (TS) | Skill to Modify Digital Documents  
| | Skill to Transfer Digital Files into iPad Acceptable Formats  
| | Skill to File Share using Cloud Services  
| Content Knowledge and Skills (CK/CS) | Assumed  
| Motivation | Perceived student engagement  
| | Convenience  
| | Reliable accessibility and immediacy of iPads  
| | Preparing students as Digital Learners in 21st century  

Table 7: Sixteen Elements of Knowledge, Skills, and Motivation in Using MT

Second, this study found that the participating teachers experienced relevant knowledge, skills, and motivation as intertwined. When they plan their lessons including iPads, these elements worked together in the planning process to achieve instructional goals, much like a domino-effect. Teachers set up the lesson with skills and knowledge, as discrete, stand-alone pieces, but motivation is the catalyst for the process. For example, BHS’s understanding of the instructional goal of deepening students understanding, initiated his planning process. To improve his teaching, he reviewed his lesson; his evaluation skill enabled him to realize that the traditional textbook content was insufficient. To deepen understanding, he wanted to use different types and levels of teaching resources to support different learner needs. His understanding of technological
knowledge—iPads capabilities—gave him the idea to create his own electronic textbook, iBook, which encouraged him to integrate iPads. His technological skills along with evaluation skill enabled him to select and modify online resources to create his own materials that support his curriculum. Because he was motivated to deepen student understanding, he required skill to evaluate previous materials, understanding of iPad capabilities to imagine possible resources, and skill to create, modify, and share digital documents to provide online resources. This planning process reveals the integrated, nature of the discrete elements of knowledge, skills and motivation that the teacher relied upon when integrating MT, specifically iPads, in teaching.

Thus, based on these teachers’ intertwined application of skills, knowledge, and motivation toward to instructional goals, educational stakeholders should be aware that teachers experience this holistically knowledge, skills, and motivation an existing discretely but in teaching with iPads were found to work in conjunction with other. Moreover, educational stakeholders should understand that MT training programs that solely focus on developing one of these elements do not benefit MT integration in the curriculum. Rather, training should begin with the educational goals, and then should develop specific pedagogical technological skills and knowledge, such as skill to evaluate teaching resources and skill to modify digital materials. Also, because each teacher covers a different subject matter and different grades, the instructional goals will be different. Therefore, educational stakeholders should design and provide different training programs for different grades and subject teachers. Through subject and grade-tailored training programs, teachers will be able to understand how to change their
pedagogical practices through MT integration and how to use learned skills and knowledge, for example TK and TS, to achieve their goals. Through the training framework, teachers should perceive the value of learning and developing new skills and knowledge and should be motivated to integrate MT.

Based on these teachers' intertwined application of TPACK, I also suggest that we need to refine the current TPACK framework to more accurately reflect teacher perceptions of the elements of TPACK, and their interrelationships. Perhaps TPACK can be redrawn as a web diagram, rather than a Venn diagram, in which the links between different components of teacher skill, knowledge and instructional goals form the inner threads and for which motivation forms the outer thread, linking all components to work together as a single whole. (figure 6).

![Figure 6: The Refinement Model of TPACK as a “Web” diagram](image)
Based on instructional goals and holistically developed knowledge, skills, and motivation, the objective is that teachers are able actively incorporate MT into practice to create innovative lessons that engage learners and better prepare them to use digital resources for learning. The effective integration of iPads into teaching and learning as described here supports achieving this goal.
Appendix A

Interview Protocol

1. Introduction
Thank you very much for participating in this study. The interview will take about 30-40 minutes to complete. Before I continue, I would like to explain the objective of this study. The purpose of this interview is to learn about your experiences regarding using iPads in the classroom. What made you decide to use iPads in your classroom, what skills have helped you to use iPads in teaching, how have you used iPads with students, and what your personal opinions on using iPads for educational purposes. Do you have any question before we start?

2. Profile of participants
• Could you briefly introduce your-self, name, subject that you teach, and how long you have been working as a teacher?
• What technology have you used in your curriculum?
• Did you have any professional development in the use of the technology?

3. Integration
• Could you tell me what it was like when you were in the process if integrating iPads?
  o Could you tell me about your preparation and planning procedures?
  o What preparation and planning have helped you the most? Why?
• How long have you been using iPads in the classroom?
• How often do you use iPads in your lessons?
• How did you use iPads for the first time for school-related work?
• How did you use iPads for the first time with your students?
• How have you used iPads for school-related work?
• How have you used iPads to teach your subject?
• Did you need to re-redesign your lessons after you decided to use iPads?

4. Participant Motivation
• What made you decide to use iPads in your classroom?
  o What factors influenced you to use iPads in the classroom?
• What were your first impressions of the using iPads for education?
5. Benefits
- What do you think about using iPads in your classroom?
- What do you like about using iPads in your classroom?
- How have iPads supported your way of teaching?

6. Challenges
- What were the weaknesses or challenges of using iPads in your classroom?

7. Components of Knowledge to use iPads
- What iPads features and applications have you used for school-related work?
- What iPads features and applications have you used to teach your students?
  - How did you learn to use new features and find new applications?
  - How have you prepared to use these apps and features to use for teaching?
- Did school provide any professional development (PD)?
  - Was PD helpful? Why or Why not?
- What resources or support have helped you prepare yourself to use iPads?
- What other devices have you used along with iPads?
  - Was the iPad alone enough?
  - Have you used any additional accessories to make iPads more effective?
- What worked and did not work using iPads in your instruction?
- How were the adjustments made?
- What knowledge or skills have helped you improve the use of iPads in teaching and learning?
- What knowledge or skills have helped you overcome the challenges of using iPads in teaching and learning?
- What technical skills should teachers have to use iPads in teaching and learning?
- What instructional styles do you suggest to use iPads with students?

8. Suggestions
- What kinds of support and resources should be provided for teachers, so that teachers can effectively use iPads for teaching?
Appendix B

Informed Consent Form

Research Title: Middle School Teachers’ Motivation and Knowledge to Use Mobile Technology in Teaching in a school in Massachusetts

I am a doctorate student in the School of Education at Boston University, and my major is educational media and technology. This research will take place from September 2013 to September 2014. This form details the purpose of the study, a description of the involvement required and your rights as a participant.

The purpose of this study is:
• gain a better understanding of teacher self-perceived needs for using mobile technology (MT) in terms of motivation and knowledge

The potential benefits of this study are as follows:
• Educational Leaders may be able to use teachers perceived needs to make an informed decisions on designing appropriate content for professional development to increase effective adoption of iPads in the classroom
• Educational technologists will know more about teacher needs as well as how to support their needs, which they could then use to provide more appropriate support and resources.
• Teacher-perceived needs will help these technologists, administrators, and policy makers recognize challenges perceived by teachers and plan for addressing them.

The methods that will be used to meet this purpose include:
• One-on-one interviews
• Classroom observations

You are encouraged to ask questions or raise concerns at any time about the nature of the study or the methods I am using. Please contact me at jeungahkm@gmail.com or 9173028258 and/or my advisor, Professor Whittier, at whittier@bu.edu or 6173533181

The interviews will be audio taped to help me accurately capture your insights in your own words. The tapes will only be heard by me for the purpose of this study. If you feel uncomfortable with the recorder, you may ask that it be turned off at any time. These recorded tapes will be destroyed 1 year after I finish my research paper.

There is no inherent risk in this study, and the interview will be anonymous and confidential. Also, you have the right to withdraw from the study at anytime. In the event
you choose to withdraw from the study, all information you provide (including tapes) will be destroyed and omitted from the final paper.

Data provided by you and other participants will be used in writing a dissertation, which will be read by my three committee members. Though direct quotes from you may be used in the paper, your name and other identifying information will be kept anonymous.
Appendix C

Code Book

Three tops Codes / 9 Sub-Codes

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Motivation</th>
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</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>Instruction</td>
<td>Benefits</td>
</tr>
<tr>
<td>Students Learning</td>
<td>Management</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>Collaboration and Cooperation</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>Technology</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Top-Code</th>
<th>Sub-Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers’ Knowledge</td>
<td>Instruction</td>
<td>Teachers’ understanding of instructional strategies</td>
</tr>
<tr>
<td></td>
<td>Instructional Strategies</td>
<td>• Teachers’ understanding of the instructional methods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teachers’ understanding of the learning motivation strategies</td>
</tr>
<tr>
<td></td>
<td>Instructional Goals</td>
<td>Teachers’ understanding of the learning goals</td>
</tr>
<tr>
<td></td>
<td>Potential Classroom Issues</td>
<td>Potential Issues with Classroom Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential Risks using Teaching Resources and Tools, i.e. Cyber Bullying</td>
</tr>
<tr>
<td></td>
<td>Classroom Environment</td>
<td>Understanding of Classroom Environment – Infrastructure condition, low bandwidth</td>
</tr>
<tr>
<td>Understanding of Students (Students’ Learning)</td>
<td></td>
<td>Students Learning Difference - different backgrounds, strengths and weaknesses, interests, ambitions, senses of responsibility, levels of motivation, and learning approaches to studying.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students Learning Behaviors – excitement, disappointment, frustration in learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understanding of Students’ Capabilities, students potentiality to use iPads in learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understanding of Students’ Abilities, students skills to use iPads in learning</td>
</tr>
<tr>
<td>Content</td>
<td>Understanding of Subject Matter / Concepts</td>
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<tr>
<td>Technology</td>
<td>Understanding of Structure of the Subject</td>
<td></td>
</tr>
<tr>
<td>Tools and Resources</td>
<td>Awareness of available digital resources/tools to present concepts</td>
<td></td>
</tr>
<tr>
<td>Digital Literacy</td>
<td>Understanding of functionalities and features of tools and resources&lt;br&gt;Understanding of the usage of tools and resources from students' perspective</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Teachers' Skills</td>
<td>Instruction&lt;br&gt;Ability to present concepts&lt;br&gt;Ability to motivate students to learn&lt;br&gt;Ability to provide guidance to enhance understanding, reinforcement, and retention&lt;br&gt;Ability to communicate lesson goals&lt;br&gt;Ability to create pedagogically powerful learning environment (i.e. individualize learning environment, and student-centered learning environment)&lt;br&gt;Ability to evaluate and incorporate teaching resources/tools in lesson&lt;br&gt;Ability to design learning challenges/activities appropriate to the specific age and students' proficiency&lt;br&gt;Ability to employ various instructional methods/tools to design lesson&lt;br&gt;Ability to analyze students' learning behaviors&lt;br&gt;Ability to assess students' understanding&lt;br&gt;Ability to reflect upon, evaluate, and improve own instructions</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>In the Classroom&lt;br&gt;Ability to notice and communicate students' misbehaviors and guide students to develop new behaviors&lt;br&gt;Ability to maintain appropriate standards of behaviors and respect&lt;br&gt;Ability to operate and manage classroom procedures within instructional times&lt;br&gt;Ability to create a safe and effective classroom environment</td>
<td></td>
</tr>
<tr>
<td>Collaboration and Cooperation</td>
<td>Ability to collaborate and cooperate with students to improve technological skills</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>Digital Literacy</td>
<td>Benefits</td>
</tr>
<tr>
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<tr>
<td></td>
<td>Ability to identify, access, evaluate digital resources</td>
<td>Instructional Support</td>
</tr>
<tr>
<td></td>
<td>Ability to create, modify, organize, and share digital media (videos, audio, photos, document) learning resources online</td>
<td>• iPads support teachers instructional strategies and help them teach subject that they need to teach including digital literacy skills / Self-directed / responsible citizenship</td>
</tr>
<tr>
<td>Technology Operation Skills</td>
<td>Ability to operate basic iPad and Apps functions/features</td>
<td>Positive influence on students learning attitude toward learning process and project quality</td>
</tr>
<tr>
<td></td>
<td>Ability to download and explore apps</td>
<td>Convenience: easy to use, handy, suitable for teachers’ needs</td>
</tr>
<tr>
<td>Motivation</td>
<td>Benefits</td>
<td>Accessibility: easy to approach, obtainable, attainable</td>
</tr>
</tbody>
</table>
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