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# High school teachers' mental model change as related to online instructional tools

James Cernansky

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**HIGH SCHOOL TEACHERS' MENTAL MODEL CHANGE AS RELATED TO  
ONLINE INSTRUCTIONAL TOOLS**

by  
James Cernansky

A Dissertation

Submitted to the  
Department of Educational Leadership  
College of Education  
In partial fulfillment of the requirement  
For the degree of  
Doctor of Education  
at  
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Dissertation Chair: Maria Sudeck, Ph.D.

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## **Abstract**

James Cernansky

### **HIGH SCHOOL TEACHERS' MENTAL MODEL CHANGE AS RELATED TO ONLINE INSTRUCTIONAL TOOLS**

2013/2014

Maria Sudeck, Ph.D.

Doctorate in Educational Leadership

The mental model shift of high school teachers regarding instructional methods related to online instructional tools was examined in this ethnographic study. The actual change in instructional techniques was also examined. Ethnographic research design was employed using teacher interviews, teacher survey, classroom observations, and lesson plan examination. The study took place at a comprehensive public high school in the mid-Atlantic region with approximately 1900 students and 200 staff members. The researcher found that a positive mental model change did occur after one year of a one-to-one iPad initiative. Teachers reported that they used online instructional tools to motivate their students with relevant and contemporary lessons. During observations the researcher found that teachers did, in fact, use the online instructional tools that they discussed in the interviews and surveys. Teachers were, however, concerned about the rigor of using online instructional tools in their instructional methods. The researcher concluded that there was a positive mental model change related to online instructional tools and that teachers utilized more online instructional methods after the implementation of the one-to-one iPad initiative.

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## **Chapter 1**

### **Introduction**

#### **Context of Study**

This study examined the mental model shift of high school teachers regarding the change of instructional methods that have occurred because of the advent of online instructional tools. While examining teacher mental model shift, the actual change in instructional techniques was also examined. Ethnographic qualitative methods were employed to examine the perceptions teachers have about using online instructional tools in their classes. Some of the methods used to gather data were teacher interviews, teacher survey, classroom observation, and lesson plan examination.

The study took place at a comprehensive public high school in the mid-Atlantic region with approximately 1900 students and 200 staff members. During the 2011/2012 school year, this high school moved to a one-to-one technology initiative in which every staff member and every student received an iPad tablet learning device. These devices have the ability to access the Internet in every area of the school and utilize applications important to nearly every academic department. This study examined the thoughts and processes teachers go through when deciding whether or not to use these iPads or other technology devices when instructing their students. More specifically, this study researched teachers' planning patterns related to online instructional tools in their plans for their classes. The actual application of these tools was also examined during this study.

During the past 10 years, this high school has gone through a population and schedule change. In 1995 there were 1000 students at the high school. This past year there were 1995 students. Therefore, in eight years there was almost a doubling of the student population. Another whole school reform change occurred in 1997. This change was that the staff decided to move forward with block scheduling as a scheduling model for the high school. There are now four 84-minute classes every day. Some classes meet twice a week and some meet three times a week, which rotates every week. This master schedule change was difficult in the beginning, but with a lot of professional development and training, the change has helped the students and staff members alike. As a result of the longer classes the teachers have been able to delve deeper into topics taught in class. The students have been able to focus on fewer classes every day and have brought more meaning to their learning as a result of teachers delving more deeply into topics taught.

The most recent change has been moving to a new high school, which occurred during the 2011/2012 school year. While the staff moved to a newly built high school, the administration also decided to deploy iPad learning devices to every student and staff member. This school is now in their second year of this iPad deployment, and the impact is mixed. Most teachers have found ways to utilize the iPad device in their classes, but some have decided to not use the iPad except for small administrative tasks.

The change of instructional planning and instructional methods that are occurring because of online instructional tools were explored in this study. Some teachers and schools are even using these online instructional tools as a main vehicle of instruction

(Webley, 2012). It is the opinion of the researcher that these online instructional tools are part of the future of education.

In this researcher's 18 years of experience as a teacher, guidance counselor, and school administrator, he has noticed, through discussion and observation, that some teachers think that technology is not necessary to teach high school students. Other teachers feel that it is imperative that we utilize technology and online instructional tools to teach high school students. In the opinion of this researcher, teachers should use technology and online instructional tools whenever possible, because our students will be expected to know how to use the technology when they go to college and/or enter the workforce. This opinion is supported in Prensky's (2001) research, which discusses today's students as having a visual learning style and that students also now have a quick payoff video game style of learning that is supported by online instructional tools.

These perceptions about whether or not online instructional tools should be used by teachers connect to research discussing the "mental images" that people create when they think about something. These mental images are being created by teachers when they plan instruction for students. These mental images lead to mental models being created by teachers about many instructional practices they do in the classroom (Strauss, 2001). Since the focus of this study was how teachers coped with moving to online instructional tools, the interaction with the teacher's mental models was critical to this research.

Interview protocol and survey questions sought to answer the following questions: How are teachers dealing with that mental model shift when they change from traditional planning and instruction to planning and instructing using online instructional tools?

What are teachers' perceptions of how to integrate online instructional tools when creating lessons? Are teachers confident when considering using online instructional tools? Why do some teachers have a negative attitude toward online instructional tools, while others enjoy using online instructional tools to enhance their instruction (Capo & Orellana, 2011)? Teachers had the opportunity to share their thoughts and perceptions about the change to using online instructional tools.

This research examines teachers' perspectives while they consider using online instructional tools. These online instructional tools have become prevalent in the past five years, so there is little pre-existing research about online instructional tools. Since the teaching profession is changing regarding planning and instruction, this study will give school administration the knowledge needed to assist these teachers as they adapt to change.

Since Capo and Orellana (2011) found that teachers were more apt to use computer technology tools for instruction if they had a positive feeling for these tools, interviewing teachers was the best instrument to use in this study. Every effort was made so that the interviews yielded teacher's true feelings regarding online instructional tools. By interviewing teachers, the researcher was able to challenge teachers to think about their existing mental models that drive them to plan and instruct in certain ways. The interview questions forced the interviewees to think about why they make certain decisions related to online instructional tools.

During teacher observations, the researcher was able to determine if teachers were using the online instructional tools. The observations supplemented the interviews which were conducted a week before the observation. These observations had a greater

importance than regular observations because the researcher was a participant observer, who works in the school where the research is being conducted. This method gives the researcher the luxury of being able to put the observations into proper perspective due to experiencing what teachers used to do before they began working with online instructional tools. Since the researcher has worked at this high school for eight years, he has noticed the instructional practices change with the use of online instructional tools.

Teachers at this high school participated in a survey related to the one-to-one iPad initiative in April of 2013. This survey has shed a light on the opinions teachers have regarding the use of iPads in the classroom. Since one of the main features of using iPads in the classroom is to access and utilize online instructional tools, this survey will show the teachers' thoughts about using online instructional tools in their classrooms. The survey added to the qualitative portion of the study.

Examining the mental models high school teachers create when they choose to plan and instruct with online instructional tools will allow school administrators to help teachers create different mental models when creating and implementing instructional plans for their classes. Mental models are images in people's minds that drive how they perceive their environment. These images impact whether or not teachers choose to use online instructional tools in their classes (Senge, 2012). Some teachers have the mental model that online instructional tools are not necessary for quality instruction. Other teachers have the mental model that online instructional tools are necessary for quality instruction. The hope for this research would be to find what mental models exist in those teachers who utilize online instructional tools effectively in their classes, and then challenge teachers who do not use these tools to replicate those mental models and move

forward with online instructional tool integration. This mental model change is necessary for teachers to instruct students using 21<sup>st</sup> century online instructional tools in their classes.

Since this high school was in year two of a one-to-one iPad initiative when the research was conducted, the researcher noticed a change in teachers' instruction. All teachers and students were given an iPad as part of this one-to-one iPad initiative and they could take them home and use them at any time of day as needed. As an assistant principal in this high school for the past three years, the researcher noticed that teachers are using many different resources to instruct their students. Some examples of these resources will follow. Some teachers used online instructional tools as their anticipatory set. Others have used online instructional tools to supplement their own instruction. Other teachers have used online instructional tools to tutor those students who had a difficult time learning the concepts the first time they received instruction. Some teachers used online instructional tools throughout the whole instructional process to their students. This shift in mental models (of technology integration into teachers' instruction) was examined to determine teachers' thoughts in planning and instruction.

The instructional change noticed in this school can be tied to the use of online instructional tools. Teachers are challenging students to take ownership of their learning by using various online instructional tools. Teachers are using response systems, wikis, group online tasks, and peer assessment (Revere & Kovach, 2011). Teachers and students are using these online instructional tools as resources to instruct and learn, replacing the books and hard copy resources that have been used for decades.

In this study, opinions and perceptions of teachers in relation to online instructional tools were examined. Teachers also shared information about which actual online tools they utilized in their classes and how their instructional methods have changed since the advent of online instructional tools. Teachers' perceptions of using online instructional tools to instruct their students were examined. Arnheim (1974) discussed the concept of dynamics in perception. He mentioned that the human mind does not stay in the simplicity state when thinking about the next life move. There is interplay between tension-heightening and tension-reducing goals (Arnheim, 1974). This relationship is important because this study is looking to notice if teachers are using online instructional tools and how they are struggling mentally with whether or not to use these online instructional tools.

Actual methods of instruction (related to technology) observed during observations of classes were addressed in this study. The change that has occurred in methods of instruction (related to technology) during the last five years of instruction was examined through material culture (lesson plans, professional development documents, and committee documents), interviews, and a teacher survey. The change in instructional method planning was noted after examining lesson plans from the past five years that teachers shared with the researcher for the study.

### **Summary of Related Literature and Conceptual Framework**

The belief that teachers' mental models impact whether or not they will plan and use online instructional tools is a driving theory in this research. The concept that teachers prepare and instruct differently because of the use of online instructional tools also drove this research. The theory that teachers will use the most contemporary online

instructional tools when they have a positive mental model of online instructional tools also was studied in this research.

Teachers have always struggled with how they should instruct their students. The advent of online instructional tools has added to that struggle (Hicks, 2011). The 21<sup>st</sup> century society has afforded students with high tech personal technology (i.e. smart phones, tablets and laptop computers). Schools and teachers have to try to keep up with technology trends to teach students with the tools they will need when they learn and work in the future (Hicks, 2011). Teachers use technology to enhance their existing teacher-centered approach to instruction (Palak & Walls, 2009). Current educational reform argues that student-centered teaching practices and the use of instructional technologies support the active learning of students (ISTE, 2000). Teachers' beliefs drive the decisions teachers make every day regarding instruction (Fullan, 2001). These beliefs feed the mental models that teachers create when planning and instructing their students. This research seeks to understand whether teachers are moving toward a more student-centered instructional approach because of online instructional tools.

The mental models of teacher instruction also framed this research. The teachers' existing mental models determine what they remember about a new experience, so their mental model may be the key determining factor as to whether or not they attempt to use online instructional tools for instruction (Senge, 2012). These mental models that are created determine if teachers decide to use or not use online instructional tools.

In order to bring focus to this study, the researcher developed a conceptual framework for the study. A conceptual framework is the lens that a researcher uses to conduct his research. A researcher should use the existing theories relative to his topic

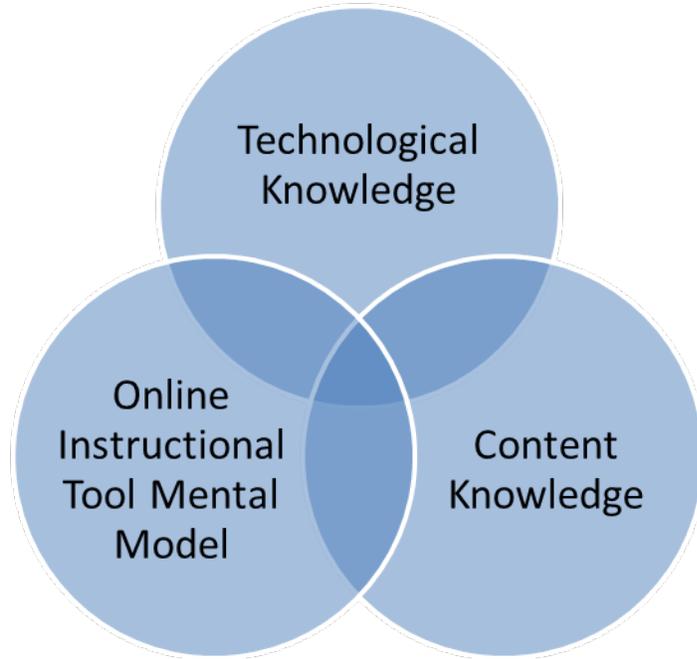
and then allow personal interests to help frame how a research study will be carried out. As a researcher reviews the related literature, his personal interests can evolve into conceptual frameworks (Ravitch & Riggan, 2012). The related literature guided the research and led the researcher to embark on rigorous studies that add to the scholarly work in the related field.

This researcher's conceptual framework is that teachers' mental models will affect their use of online instructional tools in their classrooms (Inan & Lowther, 2010). The researcher is also working from the premise that the culture that exists in the school teacher's workplace has an effect on the use of online instructional tools by teachers (Shweder, 1991). These two concepts will frame the study because there have been rigorous studies related to these topics and the researcher also agrees with these concepts from his experience as an educator for the past 18 years.

The concepts and theories that make up this study's conceptual framework can be related to each other. The mental model change occurring in teachers' perceptions of online instructional tools result in teachers' actual use of online instructional tools in their classrooms. Since the surroundings and experiences of teachers help create their mental models, the concept of social constructivism is crucial to notice perspective in how teachers will change their planning and instruction related to online instructional tools. Since the school where the research was conducted has been involved in a one-to-one iPad technology initiative, the surroundings certainly have had an impact on the mental models that teachers are creating every day as they prepare for instruction and actually instruct their students. This researcher's conceptual framework also is bound by the belief

that teachers will utilize the contemporary online instructional tools in their classes when their mental models change in a positive way.

The researcher's conceptual framework was informed by Mishra and Koehler's (2006) TPACK framework, which discusses how teachers' technical knowledge, pedagogical knowledge, and content knowledge relate to each other. Before designing this framework they found that technological aspects of knowledge (TK) needed to be considered as an integral part of other aspects of teacher knowledge. Koehler and Mishra surmised through their research that technological knowledge must be integrated with teachers' content knowledge (CK) and teachers' pedagogical knowledge (P). The researcher's conceptual framework is that teachers' mental models would fit in where the pedagogical part of the framework exists. The researcher feels that teachers' pedagogy will be affected by the mental models that teachers create related to online instructional tools. The below framework (Figure 1) shows how the researcher manipulates the TPACK framework to fit into this study.



*Figure 1.* Researcher's Updated TPACK Framework

The researcher developed a worldview to have a lens in which to view his research. The worldview that was utilized in this study is social constructivism, which is part of the researcher's conceptual framework. This worldview allowed the researcher to understand how participants in this study notice their world around them (Vygotsky, 1978). During the study there was a goal to generate a pattern of meaning from the participants in this study (Crotty, 1998). By using a social constructivism worldview, this study was also able to understand how the participants construct their views regarding online instructional tools. Since the study is examining how teachers plan and instruct students, there is a social aspect of this research (Creswell, 2007). The interviews with teachers focused on teachers' thoughts regarding how they interact with their students, which is a social construct in the classroom.

This study was also viewed through a positivist worldview, which is another part of the researcher's conceptual framework. This worldview allowed the researcher to explain the feelings (through mental models) of teachers related to their planning and instruction. The positivist worldview relates to the thought that teachers only use online instructional tools if they have a logical belief that these tools will help their students learn. The use of social constructivist and positivist worldviews allowed the researcher to both understand and explain his research (Creswell, 2007).

Regarding online instructional tool usage, teachers who decide to use online instructional tools believe they are making improvements to the world around them. These teachers give students increased responsibility to learn on their own through using online instructional tools. This increased responsibility allows students to improve their society through their learning (Hanna & deNooy, 2003). If students learn better, they have a better chance of being more constructive members of society.

As this research was being conducted, there was an examination of the procedures that teachers go through when they plan and instruct their students. Vygotsky (1978) discusses that the processes people use to impact their actions are dynamic processes that need to be examined carefully. Vygotsky notes that researchers need to look at the initial reaction as it appears and then carefully watch to determine if those initial reactions change. He explains the need to keep in mind that there is a dynamic flow of the entire process when looking at the reactions of people. These concepts were important because the premise, in this study, is that teachers may have one reaction first and then as time goes by they may change their thoughts. Because teachers at the high school studied are going through a one-to-one iPad initiative, the researcher assumes that many teachers will

have changed their mental models during this time of change. By interviewing teachers and then observing their classes, the study will also be able to verify if their reactions reflect what occurs in their classes.

The culture of the one-to-one technology school in this study is interesting because it is dynamic and changing every day. There was administrative pressure on teachers to use the iPads as learning devices from day one of the one-to-one initiative. Teachers were told by the administration that they should use the iPads as instructional tools. Teachers also had peer pressure from their colleagues who were early adopters of using the iPads in their classes. Some teachers, however, were against any change or specifically against using any technology in their class and therefore opposed to the initiative. Since many books and critical applications were on the iPads, teachers had to come on board with the one-to-one iPad initiative in order to utilize these books and applications. Teachers also came on board with the iPad initiative because the state and federal government decided in 2012 that students would have to take their standardized tests on computers starting with the 2014-2015 school year.

### **Purpose and Significance of Study**

Technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content, as well as resources and assessments that measure student achievement in more complete, authentic, and meaningful ways. Technology-based learning and assessment systems will be pivotal in improving student learning and generating data that can be used to continuously improve the education system at all levels (National Education Technology Plan, 2010).

This study is significant because the public needs to know whether or not educators are keeping up with the technological society that we live in every day. Schools are typically behind the corporate or popular culture world when it comes to technology integration (Palak & Walls, 2009). This study will show whether or not teachers are utilizing the technologies that students use during their personal lives.

The main problem that this study addressed is that teachers are not sure when, where, or how to implement online instructional tools in their plans and lessons. This study discerned what teachers are thinking about when they either embed or choose not to embed online instructional tools in their plans and instruction. This study also extended itself to try and find out whether teachers actually use online instructional tools. How teachers change the mental models that they used prior to the integration of online instructional tools is a significant piece of data that was collected.

There were some similar studies found by the researcher that identified possible gaps in the research base related to mental models and online instructional tools. Brandt (2001) carried out a similar study that determined how mental models can be used to determine how students become literate using informational technology. He found that students would learn information technology best if they could find ways to influence their mental models. This study gets close to this research, but it does not look at teachers using online instructional tools as instructional vehicles in classrooms. This study examined what mental models teachers have when they choose to use or not use online instructional tools in their classrooms.

Seel (1999) carried out a study similar to this one, which examined the problems of educational diagnosis of learning dependent progression on mental models. He found

that just looking at mental models could not immediately translate to causal models. This study evaluated whether mental models are appropriate to utilize when trying to predict what teachers will do in future situations. This research is different from this study, which evaluated what mental models teachers have when they choose to use or not use online instructional tools in their classrooms.

There is a study related to teachers' perceptions of e-learning in secondary education which has some similarities to this study. Journell (2010) noticed that teachers and students often think that online instruction lacks rigor and opportunities for engaged, social learning. Later, in the findings section of this study, a few of the teachers who were interviewed had the same concerns. However, Journell (2010) did not examine the mental models these teachers had when they decided to engage in e-learning. In fact, in Journell's study, the teacher who was studied was said to have a pessimistic view about the prospects of his online course before the course was implemented. These perceptions of teachers who implement e-learning are important, but they do not address what teachers are thinking about when they choose to use or not to use online instructional tools in their classrooms. It is important to note that e-learning is different than a traditional classroom setting in which there is a classroom teacher who chooses to use online instructional tools. In the e-learning environment, the students only have access to a teacher at certain times in an online chat room, so they do not have any face time with a teacher.

Since this study is examining the use of online instructional tools, it is logical to examine the usage patterns of technology and how it is affected by income. This fact can imply that there is an equity of resources issue related to this study. Ninety-five percent

of adults who make more than \$75,000 have said that they use the Internet at least occasionally. This can be contrasted with only 70 percent of adults who make less than \$75,000 who say that they use the Internet at least occasionally (Jansen, 2010). These statistics imply that young students are not necessarily able to model after their parents by watching their parents use the Internet. The same trends that are noted above regarding the Internet are found in the use or ownership of desktop, laptop, and tablet computers. It would be logical to surmise that these adults of lower socioeconomic status would be less likely to use online instructional tools as a learning mechanism since they may not use the Internet or computer often.

The researcher also noted when carrying out this study that there can be a problem with the equity of resources in schools. Research suggests that schools with a lower percentage of students who receive free and/or reduced lunch use technology in a way that promotes higher-order thinking (Warschauer, Knobel, & Stone, 2004). Similar findings in this study occurred when interactive whiteboards and technology facilitators were examined. The schools with a lower percentage of students who receive free and/or reduced lunch had access to more interactive whiteboards and technology facilitators. These technology facilitators are people who could help the teachers utilize the available technology so they directly influence the use of technology in the classrooms. It is logical to think that families who have less disposable income would have access to less technology. If students do not have the technology tools at home then it is logical to surmise that these students may have a difficult time using them in school to learn (Public Broadcasting Services, 2013).

Not all students who attend America's public schools have access to all of the latest technological tools at home; this lack of access by some students can create a social justice issue for educators in public schools. The uneven access to computers or the Internet has been studied by some researchers. Professor Freeman Dyson from Princeton University noted that the Internet was one of the three technologies (the other two were solar energy and genetic engineering) that could even the playing field for poor people in the world (Dyson, 1997). Professor Dyson's reasoning for seeing the Internet as such an important technology is that he feels the Internet can provide people in every town with the information and skills they need to develop their talents.

After conducting the interviews there will be an understanding of what teachers go through when they consider planning and implementing instruction with online instruction tools. By understanding what teachers go through mentally when they are considering using online instructional tools, this study should be able to help administrators create better solutions for those teachers who are choosing to resist change. The hope would be to use the data gained in this study to assist other teachers in moving forward with using online instructional tools to enhance the learning opportunities for students.

The researcher has noticed through observation of this school over the last two years that all of the stakeholders are having difficulty with the concept of online instructional tools. Teachers, students, administrators, board members, and parents are all having trouble knowing how, when, and how often to use online instructional tools. The researcher has spoken to all of these stakeholders at this high school at various times and

they all are confused as to how these online instructional tools should be integrated into the class instruction.

Teachers have a fear that they will “be perceived as incompetent” in front of their tech-savvy students because of their inability to effectively use technology in the classroom. Thus, teachers may feel inadequate or insecure in their instructional ability (O’Hanlon, 2009). Teachers do not want to look unprofessional in their classes, and therefore some teachers shy away from using technology. Another problem is that many teachers feel as though there is a lack of professional development regarding the use of technology as well as technical support for troubleshooting problems (Stein, Ginns, & McDonald, 2007).

During year one of the one-to-one iPad technology initiative in this school, the researcher spoke with many parents, teachers, and students about the challenges of being in a school where everybody has a technology learning device. Many parents called the school voicing concerns regarding their son or daughter having the ability to stay focused with an iPad at their disposal in class at all times. The researcher also had discussions with students who were mostly concerned that they had to learn a different way in their classes.

There were a few studies that the researcher noticed related to parent and student reactions to technology in the classroom. Alexiou-Ray, Wilson, Wright, and Peirano (2003) studied student and parent reactions to technology and found that 90 percent of students said that technology integration in the classroom made learning more interesting. Even students who said they were not big fans of technology said that they liked using instructional technology rather than using textbooks. Some concerns that were noted

often in this study were malfunctioning electronic devices and the inability to quickly discern the validity of information on the Internet.

In this study, Alexiou-Ray et al. (2003) found that parents were especially pleased with the ability to access homework assignments and obtain review material electronically. In fact, one parent whose child has ADD/ADHD said that her student had trouble focusing in class, so having the assignments posted electronically on the Internet helped the parent keep her child on track. The majority of parents in this study felt that the Internet was a valuable resource for educational tasks. Many of the parents did qualify their responses on surveys with the phrases, “if used appropriately” or “when used correctly” when asked about Internet use in the classroom.

During this first year of the one-to-one iPad initiative, teachers were unsure how to utilize these learning devices. Once they had some training and some time to figure out how to incorporate using applications and online instructional tools, the teachers felt more comfortable using the iPads in their classrooms. Some teachers went as far as using the iPads in some capacity every day. The other end of the spectrum saw teachers using the iPad once every week or even once every other week.

Capo and Orellana (2011) conducted research about teacher perceptions of using online technology instructional tools; they found that teachers did not plan to use online instructional tools. Data from 137 teachers from Miami-Dade County Public Schools who were surveyed were analyzed, and the authors found these percentages of teachers do not use the following technologies: blogs 51.1%, wikis 36.5%, social networking 53.3%, social bookmarking 59.9% and audio/video conferencing 41.6%. They also noted factors that were in place when teachers did use contemporary technology, such as the need to

feel confident that the technology would work in their classes. They found that teacher attitudes were the most important factor influencing using technology.

A key question of this study is whether teachers should use online instructional tools, or continue to plan and instruct students using whiteboards, notebooks, and textbooks – the more traditional methods of teaching. Many teachers might say that the “old way” of instructing students has worked well in the past, and therefore change is unnecessary. However, students now grow up with hand held computers from a very early age. It is the researcher’s opinion that the contemporary teacher should know how to instruct students using the old tried and true ways as well as integrate online instructional tools to enhance the learning of their students.

The use of online instructional tools will encourage teachers to change the way they teach. In the past, teachers have been the center of the classroom and instruction was teacher-centered (Gagne, 1965). Recently, research suggests that classes should be student centered so students can take ownership of their learning (Palak & Walls, 2009). Students should have the opportunity to learn from various different resources and access to online instructional tools allows this flexible learning. As noted earlier, students are using personal technology in all aspects of their lives. When students go to college or when adults want to learn something, they now turn to online instructional tools. Therefore, if teachers do not make the change to online instructional tools, then students will be left behind.

When examining the literature that is related closely to this study there are four studies that are similar. Brandt (2001) examined how mental models can be used to observe how students become literate. Seel (1999) examined the problems of educational

diagnosis of learning only using mental models and found that mental models alone are not causal. Journell (2010) noticed that high school teachers and students often think that online instruction lacks rigor and opportunities for engaged social learning. However, Alexiou-Ray et al. (2003) found that students thought technology integration in the classroom made learning more interesting.

The gaps in the related literature led the researcher to study the mental model change that has occurred in relation to teachers using online instructional tools in their classrooms. There are many studies related to mental models and how those models are developed by people in various fields. There are also many studies related to the use of online instructional tools by teachers. However, the researcher was unable to find any studies that put the two concepts together to study the mental model change related to online instructional tool usage by high school teachers.

### **Research Questions**

The research questions that will be addressed in this study are:

- How have high school teachers' mental models of preparation and instruction changed with the advent of online instructional tools?
- What are the changes in actual practice of instructional methods related to teachers' use of online instructional tools?

### **Specialized Vocabulary**

There are also many technology-related terms that will be discussed in this study.

A list of all terms follows here:

- Wiki Page- Collaborative website that can house documents and facilitate collaboration between teachers and students

- Adaptive Learning - Using data to personalize education for each student using algorithms
- Applications - Small programs on technology learning devices that can assist teaching and learning
- Digital Immigrant - Person who did not grow up in the information age and is not part of the “net generation”
- Digital Native - Person who grew up in the information age and is part of the “net generation”
- eTexts - Textbooks that are on a technology learning device (computer or tablet)
- Flipped Classroom - Classroom where the instruction (usually lecture) is listened to the night before class and the teacher uses class time to practice the concepts or extend the learning with activities
- Flipped Lesson - Teachers show a video for the instruction and then use the rest of class time to practice the concept or extend the learning with activities
- Flipped Thinking - Thinking about lessons and instruction differently by using technology to assist in the instruction and using class time for other things rather than direct instruction
- Google Docs - Online software that allows users to share documents and collaborate on those documents
- Mental Models - perceptions people have created from their experiences, imagination, knowledge, and comprehension of online instructional tools

- Net Generation - Generation of people who grew up using the Internet for their information
- Online instructional tools - Any instructional tool that teachers can use in their classes that utilizes the Internet or technology
- Prezi - Online interactive presentation software
- Response Ware - Application that can be used to formatively assess students
- Web 2.0 technologies – An online technology that allows users to interact and/or collaborate with each other in contrast to online technologies where people are limited to the passive viewing of a website. Examples of Web 2.0 technologies are: Wikis, eText's and Response Ware
- PBS-Public Broadcasting Service television and media corporation

### **Limitations of Study**

A potential limitation of this study was that the sample size limited how many findings and recommendations this study can make. Since there were interviews, observations, and field notes for only six teachers, the findings may not represent the whole school or other similar high schools. However, there was an online survey completed by all of the high school teachers at the high school where this research was conducted. This survey gathered data from many teachers who the researcher did not have time to interview and observe, and added rigor to this research because more data points were gained to make findings and conclusions.

Another limitation was that this study only examined one high school. There was not an examination of all different kinds of high schools (socioeconomic levels, sizes, etc.), so the findings will be limited to the high school that is being examined in this

study. However, this limitation may be a small one because this high school is similar to many across the United States. Recommendations for future studies will be addressed in another section of this study.

These limitations were addressed by using various types of data collection, such as rigor in the tools used to collect data and the triangulation of data collection. The high school teachers who were interviewed and observed mirror teachers throughout the United States because the subject matter and arts areas in which the teachers were observed and interviewed exist in most high schools across the country. Most high schools have these academic (Math, Language Arts, Science, World Language, and Social Studies) and arts (visual and practical) areas, because American high schools typically have similar classes that are required to graduate so their students can be compared with other students when they apply for colleges. With the advent of common core standards and common standards for high school teachers across the nation, this sampling of teachers could represent other populations of teachers across the United States who will be faced with the same goal of integrating online instructional tools in their classrooms.

The standard academic classes that were examined are not unique to this high school, so the issue of transferability was addressed by this fact. The fact that the researcher is a participant observer added to the rigor and reliability of this study (Creswell, 2007). The thoughts shared by interviewees and the observations were examined in a less than usual context because the researcher was embedded in the school with these teachers. This is a unique context because the researcher understands all of the variables that are in place regarding initiating a one-to-one technology environment at

this high school, and he also understands the role of the researcher in promoting the initiative.

This study was approached with the recognition of the role of participant observer. As noted earlier, this was a positive aspect of this study because the researcher would be able to bring a more informed perspective to the study. However, being in the organization can also cause bias to the findings in this study. Since the researcher is embedded in the environment being studied, it will be difficult to separate him when discussing findings and making recommendations for further research (Creswell, 2007).

### **Chapter Summary**

Chapter 1 discussed the role mental models can have on the decisions that teachers make when they plan and instruct their students. Chapter 1 also related the use of online instructional tools and the mental models teacher have about technology use in their classes. This introductory chapter discusses the decision of whether or not teachers will use online instructional tools and how their existing mental models drive this decision. The definitions of mental models and online instructional tools are also given and discussed in Chapter 1. The conceptual framework, purpose, and significance of this study are also shown in Chapter 1.

Chapter 2 will show relevant literature that is related to mental models, culture, and online instructional tools. The literature informed the research questions that were noted above. Authors who are leaders in the mental models field will be referenced with examples from their works noted. The background of teachers starting to use technology and online instructional tools is examined and discussed in the literature review section.

Chapter 3 goes into detail about the methods used to conduct this research. Here, the data sources will be shared to inform this study. There is a discussion on how data were collected, analyzed, and triangulated throughout this research.

Chapter 4 shows the findings that were gleaned from this research. What was learned from the data gained through the research will be shown in this chapter. The findings section will give meaning to the data found in this research. Here there will also be a discussion regarding what will be done next with these findings. A discussion about how the findings fit in with the existing literature will also be conducted in this chapter.

The final chapter of this dissertation presents a discussion about leadership and offers conclusions and implications for this study. The greater educational context will be shown in this final chapter. The issue of the change process will also be discussed in this chapter. Recommendations for future research will be shown in this chapter.

## **Chapter 2**

### **Literature Review**

#### **Introduction**

As noted earlier, this study examined the mental model shift of high school teachers regarding the change of instructional methods that have occurred because of the advent of online instructional tools. In order to understand the topic of mental models and online instructional tools, a literature review of research was conducted that is related to both mental models and online instructional tools. There are sub headings, which will focus the larger headings of mental models and online instructional tools.

#### **Mental Models**

Mental models are important to this study because the researcher was trying to understand what teachers are going through mentally when they consider planning to use or actually using online instructional tools in their classes. The mindset of the teachers that were interviewed, surveyed, and observed is paramount in this study. The models that are created in teachers' minds related to their prior experiences has an important impact on whether or not teachers will choose to use online instructional tools in their classes.

**Mental model theory.** This study was framed by mental model theory. The mind creates models from perceptions people have created from their experiences, imagination, knowledge, and comprehension of discourse (Johnson-Laird, Girotto, & Legrenzi, 1998). Johnson-Laird (1983) first used the term mental model, which refers to an internalized, mental representation of an idea. Craik (1943) is thought to have first developed the idea

of mental representations. These mental model representations guide the actions of people.

Closely related to mental models is the concept of schema introduced by Jean Piaget in 1936. Piaget (1936) defined the concept of schema as a repeatable action that possesses component actions, which are tightly interconnected and housed in a core meaning. The schema are the building blocks of intelligent behavior. When teachers are forming their mental models about whether or not to plan or use online instructional tools, they have to fall back on their schema that was developed through various instructional events in the teachers' lives. The mental models that people create can be thought of as groups of schemata that have been created by various learning experiences that these people have been exposed to before. Mental models can also be thought of as an extension of schema, where a person would put together their various schemata and relate their schema to actual task demands and task performances (Stein & Trabasso, 1982).

The concept of images in mental models will become critical in this research. Mental model images will be important because teachers tend to plan and teach students and classes the same way they were taught, which is in keeping with their mental image of how a class is supposed to run (Johnson-Laird, 1983). These mental models that teachers who do not use online instructional tools have in their minds will have to change if they are going to effectively use online instructional tools in their classes. This study identified what teachers' perceptions are regarding the transition to using more online instructional tools.

The process teachers go through when they are thinking about their instruction has certain parts and an order. The parts are: the actual mental model, the conceptual model, and the target system. The actual model is envisioned by the user. The conceptual model is an accurate model of the system created by the designer, and the target system is what the user interacts with in the model (Norman, 1983). In this study, the actual model will be the online instructional tools envisioned by teachers. The conceptual model will be the use of all instructional tools, and the target system will be the overall instruction that is implemented by the teacher.

P. N. Johnson-Laird researched inference and mental models, images and mental models, and characteristics of mental models. P. N. Johnson-Laird also discussed the characteristics of mental models (Johnson-Laird, 1983). Since this study is examining what teachers are going through mentally as they plan and instruct students in a highly technological society, an understanding of mental models will be critical.

One can make logical conclusions using mental models. Johnson-Laird (1983) gives the following example, “all prudent men shun hyenas, all bankers are prudent men, and therefore all bankers shun hyenas” (p. 74 ). This example is both simple and logical. However, there can be some problems with using inference in this way. If you changed the word “all” to “some” above then you cannot make the same assumptions. This is important regarding the research question related to whether or not teachers feel threatened by the advent of so many online instructional tools. A logical person could assume that since there are so many online instructional tools available, that every teacher should use them in some way. However, some teachers have not. Therefore, using

inferences related to mental models can be problematic. One cannot assume that similar people will have the same mental models just because they are similar in other ways.

The aspect of images in mental models was important in this research because images in this case refer to the mental representations people have in their heads, which drive how they perceive their environment. There are two schools of thought related to these images. They can be viewed like an image of an object, or a picture. Mental model images can also be thought of as a proposition in an abstract manner (Johnson-Laird, 1983). This means that a person may not know that their minds are creating mental models at all times.

These images can be different for different people who are in the same organization and who go through the same environment. Senge (2012) discusses how a person's mental models determine what is noticed. He notes that in any new experience most people will remember only the information that reinforces their existing mental models. That idea is critical for this research study because the use of online instructional tools is a new experience for most teachers, and consequently they will be processing these new experiences through their existing mental models.

Mental models represent a state of affairs for a person (Johnson-Laird, 1983). These models mirror the relevant aspects of the world that surrounds a person. People create their mental models from experiences and perceptual information (Johnson-Laird, 1983). Marr (1976) discusses these mental models as "the primal sketch" of a visual process of a person. These "primal sketches" are constructed all the time by people, and often changed depending on many variables. Teachers may talk with a colleague or

attend a professional development course and make changes to their mental model of what could occur instructionally in their classes.

People try to construct mental models of situations using assumptions of what conclusion fits with certain past experience models. People reason through situations by attributing rules to a given condition. Like the example above, Schaeken, Vandierendonck, Schroyens, and d'Ydwewall (2013) share an example, which states, "if it rains the street gets wet; if the street gets wet, it is slippery; and therefore if it rains, the street is slippery" (p. 2). Rules given to conditions will be an important concept to this study because the condition that education is in right now related to technology does not have many rules, but there are assumptions made about the rules related to technology that affect all education stakeholders. For instance, the assumption that every student can research effectively using the Internet may not be correct.

**Mental models in education.** Mental models can be the best way to address teachers' thoughts about planning and instruction (Strauss, 2001). Theories or pedagogical content knowledge can also be ways to explain a teacher's thoughts about planning and instruction. The assumption in this research is that teachers create mental models about how they will create lesson plans and how they will instruct their students. This study considers how these mental models have changed now that teachers have access to online instructional tools.

Strauss (2001) suggests that mental models organize teachers' thinking and teaching behaviors. He mentions that there are cognitive processes that occur when a teacher is trying to plan how they will teach their classes. Teachers make assumptions regarding the efficacy of their instructional techniques (Strauss, 2001).

Mental model theory is also used in problem solving in people's minds. People use reason to try and solve problems. If teachers think of what they will do to teach their students, they are using mental models of what that instruction will be in their classes. Teachers will use experience-based deductive reasoning to determine the best way to instruct their students (Evans, 1993).

It can be said that mental models are designed in a person's working memory. A person's working memory is where a person "thinks" about what is occurring. People create these working memories from their everyday experiences (Lee et al., 2004). This study examined these experiences that teachers have related to planning and utilizing online instructional tools in their classes.

There are many studies that examine educational mental models. Seel (1999) examined the problems of educational diagnosis of learning-dependent progression on mental models. Through his research, he found that mental models could not immediately translate to causal models. This study focuses on the question whether mental models are appropriate to utilize when trying to predict what teachers will do in future situations.

In another educational mental models study, Journell (2010) noticed that teachers and students often think that online instruction lacks rigor and opportunities for engaged, social learning. Journell's study found that the mental models teachers and students created have influenced their thoughts about online instruction. Later in the findings section of this study, a few of the teachers who were interviewed had the same concerns. However, Journell (2010) did not examine the specific mental models these teachers had when they decided to engage in e-learning. In fact, in Journell's study, the teacher who was studied was said to have a pessimistic view about the prospects of his online course

before the course was implemented. These perceptions of teachers who implement e-learning are important, but they do not address what teachers are thinking about when they choose to use or not to use online instructional tools in their classrooms. It is important to note that e-learning is different than a traditional classroom setting where there is a classroom teacher who chooses online instructional tools. In the e-learning environment, the students only have access to a teacher at certain times in an online chat room, so they do not have any face time with a teacher.

The key theories and unique aspects of each theorist are listed in Figure 2.

Theorist	Piaget	Johnson-Laird	Senge	Craik
Key Theories	Schema as building blocks to learning	Perceptions people have created from experiences, imagination, knowledge and comprehension of discourse	Mental Models are deeply ingrained assumptions, generalizations, pictures, or images.	Internal conception which exists inside the mind of the individual
Unique aspects	Groups of schemata create mental models.	Mental models are propositions in an abstract manner.	Any new experience gets remembered in context with images.	First developed the idea of mental representations.

*Figure 2.* Key Theorists Related to Mental Models.

Earlier in this literature review, it was said that mental models are the images that people create from their experiences. The way that people interpret their experiences refers to the perceptions people create (Heffner, 2001). These interpretations inform the mental models that people create. Therefore, mental models are inextricably linked to perceptions. Perceptions inform the mental models that people are creating all the time.

Perception is the organization, identification, and interpretation of sensory information in order to represent and understand the environment (Schacter, 2011). The word perception means recognition and interpretation of sensory stimuli based chiefly on memory. It also refers to quick, acute, and intuitive cognition. Another meaning of perception is a way or process of conceiving something (Heffner, 2001). All of these definitions are related to operations of the mind. The mental models people create are also representations from the mind, which explains why perceptions and mental models are closely associated.

This study examines teachers' perceptions of using online instructional tools to instruct their students. Arnheim (1974) discussed the concept of dynamics in perception. According to Arnheim, the human mind does not stay in the simplicity state when thinking about the next move in life. There is interplay between tension-heightening and tension-reducing strivings in people (Arnheim, 1974). This interplay or connection is important in this research because the researcher is trying to determine if teachers are using online instructional tools and how they made that decision.

As can be noticed from the previous section, mental models impact teachers' use of instructional tools in their classes. The next section will examine the relevant literature related to instruction and technology. It was important to examine the relevant literature

about instruction and technology because those are the concepts this study is examining with mental models.

### **Instruction and Technology**

Technology use in schools is a hot button issue right now in education. Students now have access to many personal technologies, and have an expectation that they will use technology to learn in and out of school. Some teachers are concerned about not knowing enough about technology to utilize it effectively in their classes as an instructional tool (O'Hanlon, 2009). According to Alexiou-Ray et al. (2003), 83 out of 92 students thought technology integration in the classroom made learning more interesting. This study also surveyed parents and found that a majority of parents felt that the Internet was a valuable resource for educational tasks. The following literature review related to technology and instruction will show how technology is perceived by teachers and used as an instruction vehicle by teachers in their classes.

The concept of what variables are in place when teachers choose to plan or instruct using online instructional tools is important because the researcher wants to help teachers feel comfortable with using online instructional tools. Brandt (2001) carried out a study that determined how one can use mental models to determine how students become literate using informational technology. He found that students would learn information technology best if they could find ways to influence their mental models. This study gets close to this research, but it does not look at teachers using online instructional tools as instructional vehicles in classrooms. This study examined what mental models teachers have when they choose to use or not use online instructional tools in their classrooms.

**Online instructional tools – teacher perceptions.** Capo and Orellana's (2011) study of 75 teachers' Web 2.0 usage revealed a general lack of interest in classroom engagement of such technologies. They found that more than half the teachers interviewed did not plan to use wikis, social networking, and social bookmarking, or audio/video conferencing which make up Web 2.0 technologies. Teachers had a negative image of Web 2.0 technologies because they were not convinced that the Web 2.0 technologies would help their instruction, and they also felt that the administration were not always fully supportive of teachers using technology.

Web 2.0 is technology that allows teachers and students to extend their learning about a topic and often allows the collaboration between teacher and student. A web 2.0 technology is an online technology that allows users to interact and/or collaborate with each other in contrast to online technologies where people are limited to the passive viewing of a website. The general thought separating Web 1.0 and Web 2.0 is the interaction between the user and the Internet. There are ways to interact with the Internet now instead of just viewing information. Collaborating with peers or teachers is the next step for students using the Internet in school.

Public Broadcasting Services learning media (2013 surveyed 503 teachers of pre-kindergarten through grade 12 teachers in 2013 to find out whether or not teachers embraced digital resources to increase learning. In contrast to Capo and Orellana (2011), the Public Broadcasting Services found that 74% of teachers thought that educational technology is a student motivator. This study found that more than two-thirds of teachers want more classroom technology. Another finding in this study showed that 74% of teachers used educational technology to reinforce and expand content in their classrooms.

This shows that teachers do want to use educational technology and that teachers realize the value that educational technology (including online instructional tools) can have on student learning.

In a related study, Inan and Lowther (2010) found that teachers who have a positive view towards computer technology are more apt to use computer technology in their classrooms. They also found that these same teachers are most likely the teachers who will have positive views of online instructional tools. Therefore, it can be inferred that if teachers have a positive view of using online instructional tools then there is a good possibility that these teachers will utilize online instructional tools.

**Instructional technology.** Some teachers have started to use many online instructional tools in their classes. Some of these online instructional tools are response systems, discussion boards, chat sessions, wikis, group online tasks, and peer assessment (Revere & Kovach, 2011). These online instructional tools have been designed to engage students and motivate them to work harder or engage more readily and for longer duration with academic content.

If schools have access to a one-to-one technology environment, then the teachers can utilize online instructional tools more effectively. A one-to-one technology environment means that all students and teachers have a technology device they can utilize in class and at home. This environment encourages students and teachers to utilize the technology since they always have it at their disposal in school and at home.

Teachers must research all of these online instructional tools before they can be deployed to students. These online instructional tools must fit in with the teachers' plans while they create instruction that is related to the common core academic standards, and

they must supplement the curriculum that is developed by the school the district. If teachers find a quality online instructional tool then they can add that to their resource list that they would share with their students. Teachers can then go back to that online instructional tool resource whenever it can be used to assist student learning. Much of the problem with online instructional tools (or any technology instruction) is the fact that teachers must feel comfortable with the change. Instruction in a teacher's classroom is a personal place for teachers. Teachers feel that the classroom is their domain and that they control what occurs in their domain (Wang, 2002). Teachers must feel comfortable if there is a potential change to the delivery of instruction.

Evidence exists that demonstrates using technology as an instructional tool improves student learning and educational attitudes (Hanna & de Nooy, 2003). Shana (2009) found that online discussion forums had an obvious impact on student achievement and attitudes toward learning. In this study, there were students who had access to online discussion forums and students who did not have access to the online discussion forums. There were 34 university students from the United Arab Emirates who were divided into two groups. Even though both groups indicated that learning occurred, the group that had access to the online discussion forums performed better in the class. The group with access to the online discussion forums also indicated on their surveys that they had a better attitude related to their learning.

These students that teachers are now educating have grown up in the digital age or information age who are known as the "net generation," have had access to personal technology at a very young age. These students can be called "digital natives" because the world they grew up in has many personal technology devices and other technological

devices. Adults or older students who have not grown up in the digital or information age are known as “digital immigrants,” because they did not start in the personal technology world, but now have to adjust and live in the technological world (Dessoif, 2010).

According to Prensky (2001), the prevalence of technology in everyday life has shifted students to a more visual learning style. Therefore, students may not learn well in the traditional lecture and textbook reading teaching method. Many of the students today are bored with the traditional style of teaching. The digital native students are accustomed to twitch-speed, multitasking, random-access, graphics-first, active, connected, and quick payoff video game style of learning (Prensky, 2001). These students often stop listening to the teacher (who is most likely a digital immigrant) who lectures and relies on textbook and worksheets for their learning.

In order to determine the benefits of using online instructional tools, there was an examination of many studies that compared pen and paper instructional tools to online instructional tools. One of these studies compared the use of pen and paper versus online instructional tools, which are used as formative assessments. The use of formative assessment tools with technology has proved beneficial to measuring learning in various classes. Brewer (2004) studied using these formative assessment tools in college biology classes. In her study, both faculty and students found that the technology helped to improve students’ overall understanding of biological principles and concepts. The study consisted of giving students an off-the-shelf pen and paper self-assessment tool to assess their learning. The study also offered a web-based assessment tool to allow students to self-assess between lectures. After reviewing the surveys of students and staff members,

Brewer found that both students and staff members liked the web-based self-assessment tool better than the pen and paper self-assessment tools.

Mishra and Koehler (2006) developed a model that improved understanding of technology use by teachers as instructional tools. They developed the TPACK framework, which discusses how teachers' technical knowledge, pedagogical knowledge, and content knowledge relate to each other. Before designing this framework, they found that technological aspects of knowledge (TK) needed to be considered as an integral part of other aspects of teacher knowledge. Koehler and Mishra surmised through their research that technological knowledge must be integrated with teachers' content knowledge (CK) and teachers' pedagogical knowledge. They found that if teachers are able to integrate the technological knowledge and the content knowledge, then these teachers were determined to be effective using technology to enhance instructional learning for their students.

Mishra and Koehler's (2006) framework is important to this research because at the intersections of technological knowledge, content knowledge, and pedagogical knowledge lies the optimal integration of technology that can create an excellent learning environment for students. The existing amount of technological knowledge, content knowledge, and pedagogical knowledge will affect the ability of teachers to utilize technology in their classrooms. If teachers have a high level of aptitude in all of these areas then they will have the ability to use technology (like online instructional tools) as an instructional resource in their classes (Mishra & Koehler, 2006)

The TPACK framework pulls together the three aspects of technological pedagogical content. There are three times when two aspects come together and the

teacher is getting close to optimal technology integration. When all three of the circles merge, the teacher will be at an optimal level of using technology as an effective instructional tool.

When thinking about the TPACK framework in relation to this study, the researcher chose to put the mental models that teachers create at the pedagogical level. When teachers decide how to instruct their students, this decision-making process and the action of instruction defines their pedagogy. The researchers' variation of the TPACK framework shows that if teachers have the technical knowledge, content knowledge, and the positive mental model and perception of online instructional tools, then teachers will plan and utilize online instructional tools in their classrooms. Therefore, the researcher is putting the online instructional tool mental model where the pedagogy knowledge section would be in Mishra and Koehler's (2006) framework.

Not all students who attend America's public schools have access to all of the latest technological tools. This lack of access by some students can create a lack of equitable resources for students in public schools. Since social justice issues are related to equity the access to technology is a social justice issue. The uneven access to computers or the Internet has been studied by some researchers. Professor Freeman Dyson from Princeton University wrote that the Internet was one of the three technologies (the other two were solar energy and genetic engineering) that could even the playing field for poor people. His reasoning for seeing the Internet as such an important technology is because the Internet can provide people in every village with the information and skills they need to develop their talents (Dyson, 1997). If students do not have the access to these

technological resources then, it can be said, that they are at a distinct disadvantage to their peers, in other areas, who have access to these technological tools.

Equity of resources has been determined to be an important concept related to this study because of the lack of equity and computer technology. Since this study is examining the use of online instructional tools it is logical to examine the usage patterns of technology and how it is affected by income. Ninety-five percent of adults who make more than \$75,000 have said that they use the Internet at least occasionally. This can be contrasted with only 70 percent of adults who make less than \$75,000 who say that they use the Internet at least occasionally (Jansen, 2010). These statistics imply that young students are not able to model after their parents by watching their parents use the Internet. It would be logical to surmise that these adults of lower socio economic would be less likely to use online instructional tools as a learning mechanism since they may not use the Internet or computer often outside of learning environments.

Continuing with the equity of resources factor related to online instructional tools, and technology use in schools, there is research that suggests that schools with a lower percentage of students who receive free and/or reduced lunch use technology in a way that promotes higher-order thinking (Warschauer et al., 2004). Similar findings occurred when interactive whiteboards and technology facilitators were examined. The schools with a lower percentage of students who receive free and/or reduced lunch had access to more interactive whiteboards and technology facilitators. These technology facilitators could help the teachers utilize the available technology so they directly influence the use of technology in the classrooms. It is logical to think that families who have less disposable income would have access to less technology learning tools. If students do not

have the personal learning technology tools at home then they may have a difficult time using them in school to learn (Public Broadcasting Services, 2013).

The environment that exists when teachers' mental models are being created related to online instructional tools is important in this study because the culture that the teachers' work in has an effect on the perceptions and mental models that teachers create. A review of the literature related to cultural factors was carried out to give context to the environment where these mental models are being developed. Since a school is such a social environment, many stakeholders are interacting on a daily basis to keep the school working every day.

### **Cultural Factors**

The pedagogical culture that the teachers reside in while they work at this high school is important to this research. The definition of culture that would be used for this study would be the behaviors and beliefs of a social group. This group can then develop and improve the mind by education and training (Marshall, 1998). The behavior patterns of the teachers interviewed, observed, and surveyed are important because they shape the attitudes of the teachers. These attitudes affect the mental models that are developed by teachers. Teachers' behavior patterns are influenced by their interactions with colleagues in their school, their academic teaching department, and their social friends within the school (Shweder, 1991). This culture is important to recognize because teachers no longer teach in isolation. In the school that was researched there have been many more observations of classes than there have been in the past. New teachers who have been teaching three years or less went from three observations to five observations, and tenured teachers who have taught from four through 35 years went from two observations

to three observations. This school also has high expectations for teachers to utilize the most contemporary instructional techniques available. During the year this school was researched, the school had a goal that all teachers would develop their own wiki pages for use in their classes. Thus, school culture was influenced by these goals and school administration put an emphasis on using technology.

Regarding the behaviors that people exhibit, Shweder (1991) researched cultural psychology, and explained that psychological and behavioral tendencies are rooted in and embodied in culture. He notes that mind and culture are inseparable and that people are shaped by their culture and their culture is also shaped by them. Daily interactions within an organization reinforce cultural behaviors. For this study, an example would be how teachers feel when they notice a colleague share an instructional practice using online instructional tools at a faculty meeting. This interaction would make teachers who are not using online instructional tools feel that they should try them because their colleague is using the online instructional tools in their classes and receiving recognition. There are countless interactions between colleagues at a high school that shape how and what the teachers will do related to instruction in their classes. In fact, the high school that was researched has teacher workrooms where the teachers can work and collaborate easily because of the proximity of the workspaces and the availability of staff conference rooms.

The way things get done in an organization is important when examining culture. Deal and Kennedy (2000) studied models of culture and developed 4 different types of organizations. The 4 organizations are work-hard, play-hard culture, tough-guy macho culture, process culture, and the bet-the-company culture. The work-hard, play-hard

culture is high stress and has a rapid feedback/reward and low risk coming from a high quantity of work. The tough-guy macho culture has a high risk and rapid feedback/reward, which results in high stress from the potential loss/gain of reward. The process culture has a slow feedback/reward and low risk, which results in slow, plodding work with comfort and security. The bet-the-company culture has slow feedback/reward and high risk which results in high stress, but delay in knowing if actions have paid off (Deal & Kennedy, 2000). Understanding what type of culture exists in an organization is important to understand the behaviors of the workers in the organization.

The public high school that was studied would fall into the process culture. Most public schools would fall into the process culture because teachers have the ability to acquire tenure, which makes it very difficult to fire a teacher, which leads to high job security. Within this security there is a premise that teachers should act like the teachers of the past because present day teachers know the successes that those teachers enjoyed. There is very little incentive to be on the cutting edge of instruction or technology in a public school environment.

To add to the thought that public schools are difficult to change, Schein (1992) found that organizational culture is the most difficult organizational attribute to change. He notes that the organizational culture will outlast organizational products, services, founders, leadership, and any other physical attributes of an organization. Schein (1992) created a model of an organization with three different levels. The first level is the organizational attributes or artifacts that can be seen, felt, and heard by the observer. The main artifact that affects the culture in the school that was studied is the iPad learning device that students and teachers have at their disposal. The next level is the professed

culture of an organization's members, sometimes noted as values. The last and deepest level is where the organization's tacit assumptions are found. All of these levels are pertinent to this study. Through interviews, survey, and observations, the researcher was able to understand the culture of this school before the one-to-one iPad initiative and how the culture changed after the one-to-one iPad initiative.

The process of changing an organizational culture can be very difficult for many reasons. One major reason organizational culture change is difficult is that organizational cultures often reflect the "imprint" of earlier periods of the organization and workers have strong relationships with this "imprint" (Marquis & Tilcsik, 2013). The "imprint" of using direct instruction at the high school that was studied, is probably similar at most high schools across the country. The change in culture to using online instructional tools in a constructivist learning model is starting to happen at the school that was studied, and thus could happen in other high schools.

In Senge's (2012) book, *Schools That Learn*, he discusses the five disciplines of organizational learning. In the 4<sup>th</sup> discipline, Senge discusses team learning. He states that team learning is group interaction where small groups of people transform their collective thinking. In these small groups, people work towards common goals and draw from an intelligence and ability that is greater than any individual could create (Senge, 2012). In the case of the school in this study, the teachers are the small group that is trying to "learn" how to utilize online instructional tools as they transition to a more student-centered instruction model from a teacher-centered instruction model.

As can be noticed through the related literature, the culture of an organization has a large impact on implementing change. An entity like a public school has a very

dynamic culture with deeply embedded practices that have occurred for a very long time. The culture in a school is also driven by many social constructs. New teachers are immediately mentored into the culture that exists in a school and oftentimes change can be difficult because of the culture of a school building.

### **Instruction**

Since teachers exist in a world where technology is becoming more prevalent, they will continue to have more experiences with technology. These experiences may inevitably lead to more implementation of online instructional tools. Teachers' process of planning and instruction will change dynamically because of these interactions with the existing world around them (Vygotsky, 1978). Challenging teachers to become introspective related to their planning and instruction with online instructional tools will potentially cause changes in their instruction. This introspection and challenge process will potentially effect change in their instruction.

Traditional instructional methods are the initial mental models that have been created by teachers. Experienced teachers have been instructed, when they trained to become teachers, to use textbooks, notebooks, and other traditional tools to teach their students. The vehicle and resources available for their instruction has changed in recent years (Capo & Orellana, 2011). Teachers now have many online options for instructional tools to supplement the traditional tools that they have been taught to use in their classes.

In 1965, Gagne discussed various instructional events that are related to the learning process. In his research, he shows that there are explicit events that need to occur before students can learn information. These teaching events can vary, between direct instruction variation or other styles of instruction. These events are the backbone of

teacher instruction and affect the efficacy of student learning. The events can allow students to learn the material to be taught effectively or the events can have little impact on students and therefore the students will not learn the material. Some examples of these events are: stimulating prior knowledge, presenting the material to be learned, and practicing skills related to learning. These events have led to traditional instructional methods.

The process that most teachers use to instruct students is called direct instruction. This type of instruction began in the 1960s when researchers began discussing certain sequences of instruction (Engelman, 1970). The sequence usually affords a teacher to access students' prior learning about the topic. Next, there would be instruction regarding something new introduced to students. The teacher would then practice the new concept or concepts. At the end of a lesson, there should be some type of formative assessment to determine if the students have learned the concepts that have been taught or introduced. These sequences of instruction have always been given directly, but now teachers can use online instructional tools to access prior learning, deliver the instruction, practice, and assess the instruction of the students (Engelman, 1970).

The research assumes that presently most teachers in most schools utilize the traditional instructional model. This model has the teacher delivering the instruction during class and then the students reinforce the instruction through homework. Some online instruction creators, educators, and policy makers recommend students view the instruction online the night before the class and then the teacher expands on learning or assigns activities the next day in class (Webley, 2012). This process is called the "flipped classroom," because the teacher is reversing, or flipping, what has typically happened in

class, and allowing students to do the “homework” in class with the teacher present. This method would assist students who would typically struggle with homework alone. Some proponents of online instruction tools think that there should be a blended approach to instruction where the teacher can do some of the traditional methods and use online instruction also to enhance the learning experience (Dewald, 2003). Both instructional methods are based in research, therefore student learning should occur using either method.

The problems with traditional models of instruction are that they can only help students achieve a fraction of the quality education needed in the information age (Shana, 2009). Teachers and students need to expand on the existing curriculum in order to succeed in the information age. Online instructional tools allow this extension of the learning to occur. These tools give students access to the wealth of information that is on the Internet and available in various computer software and hardware platforms. The mission for secondary education and higher education should be to utilize tools that students will need to use in the future to succeed in education and the workforce. The more contemporary teaching method, which has begun to be utilized within the past 10 years, is constructivist learning. In this teaching method, the instructor is a facilitator who is responsible for process design, creating the climate for learning, and making resources available to the students so they can learn (Dewald, 2003). Using constructivist-learning, teachers can set up the parameters for learning and allow students to discover the information using various tools. In the past, the teacher was the main instrument of instruction. Now students can be the main instrument and choose how they will learn the

concepts. This method also allows teachers to assess students in various ways because students can create many products to prove that they have learned the material.

By contrast, the use of direct instruction in the traditional manner can be determined to be a simple way of teaching students. If teachers are using online instructional tools to instruct their students, they are using more dynamic means to instruct their students. Arnheim (1974) discusses this concept of simplicity versus dynamics. He mentions that the human mind has interplay of tension-heightening and tension-reducing strivings. Arnheim argues that the human mind is constantly at work organizing the interplay of simplicity and dynamics. These thoughts align with the above statements regarding the positive or negative experiences teachers have had with technology, which directly affect their desire to use online instructional tools in their classes. Therefore, if teachers have positive experiences with online instructional tools then they will be more dynamic in their planning and utilization of online instructional tools.

Krauskopf, Zahn, and Hesse (2012) studied the role pedagogical knowledge and mental models of technology play in informing teachers' decisions for lesson planning and instruction of students. They suggest from their findings that there is a strong connection between having a positive mental model of the technology tools' instructional value and a strong professional knowledge of teaching. Therefore, using this research as a base, it can be said that if teachers are comfortable in their teaching, then they have a better chance of using technology in their classes.

One reason teachers will have to begin using technology in their instruction is so they will fall in line with the new common core academic standards, which are required

by the State of New Jersey Department of Education. The common core technology standards state that teachers have to encourage students to create presentations and other technology creations enhancing and showing what they have learned. Students are asked in the common core technology standards to publish their findings in labs, assignments, and activities within technology. The common core also states that students should learn how to collaborate with other students and teachers using technology. There are also some high-level common core standards related to technology, such as, using technology to solve problems and make informed decisions. Also, the common core expects students to evaluate the advantages and disadvantages of using different mediums (National Governor's Association, 2012).

Teachers will be required to utilize online instructional tools through the Common Core State Standards that came into place for schools during the 2012/2013 school year. Standard 8 notes what needs to occur with educational technology throughout grades Pre-Kindergarten through 12<sup>th</sup> grade. Standard 8.1 says that students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems (National Governors Association. 2012). The use of online instructional tools to deliver instruction will cover this standard. For instance, when a teacher tells a student to logon to the teacher's WIKI to access information needed for class, students will be using digital tools to access and manage information for their class.

Online instructional tools are also important to schools due to high stakes assessments that are coming to various states. The Partnership for Assessment of Readiness for College and Careers (PARCC) is a group of states working together to develop a set of assessments that measure whether students are on track to be successful

in college and their careers (PARCC, 2014.) As of April 2014 there were 19 states as part of this consortium. These assessments are aligned with the new, more rigorous Common Core State Standards. The goal of these assessments is to ensure that every child is on a path to college and career readiness by measuring what students should know at each grade level. Starting in the school year 2014/2015, the 19 states will have to administer these assessments through some type of online technology. There are pilot test sites that started testing during the 2013/2014 school year. Having students and teachers using online instructional tools before they are required by this assessment causes the students and teachers to have less anxiety taking these assessments online during the 2014/2015 school year.

The use of online instructional tools by teachers requires leadership in the organization where teachers reside. School leadership must be part of the mental model change of planning and using online instructional tools. General leadership research and research about the researcher's leadership traits will be discussed in the next section.

### **Leadership Challenges and Opportunities**

The analyzing of mental model change related to online instructional tools has implications for leadership. Some key leadership scholars have discussed mental models, online instructional tools, and culture, which are key aspects of this study. Since teachers are going through the change of their mental models, the leadership in a time of change is also critical research to be reviewed for proper perspective in this study so change can be guided and supported.

When thinking about school leadership, one must start with the Interstate School Leaders Licensure Consortium (ISLLC) standards for school leaders. These are the

leadership standards that school administrators follow all across the country. The second standard is especially applicable to this study. This standard states that school leaders must develop a school culture and instructional program that is conducive to student learning and staff professional growth (Council of Chief State School Officers, 2008). Since this study is examining online instructional tool usage by teachers, this study is directly related to the instructional program being offered in the studied school.

There are leadership implications that arise from allowing students and teachers to use the Internet for instructional purposes. In the short term, school administrators must allow teachers to try new instructional techniques with the Internet without penalty for imperfect lessons. School administrators need to give teachers access to professional development related to using the Internet for instruction. There is a change element that school administrators must be aware of when supervising teachers who are transitioning to using the Internet as an instructional tool. Fullan (2001) discusses that teachers need time to merge their new knowledge into their instructional practice. Fullan further states that the adoption of a technology change usually goes through three stages: adoption, implementation, and continuation. The school that was studied was in the implementation stage transitioning to the continuation stage.

One of the main purposes of an educational leader is to increase the leadership capacity of others. Fullan (2007) discusses the concept of developing leaders as a way to sustain change in an organization. As a leader you must delegate and share the leadership burden with the stakeholders that you work with, in a school they are the teachers and professional support staff. If a leader can work with these people to assist in carrying out the message to the staff, then the school will run more smoothly and the goals of the

school will have a better chance of being met. If teachers begin to utilize online instructional tools, then they can become leaders by sharing their best practices with their colleagues. By working with teachers on their mental model related to online instructional tools, the researcher will be able to increase the capacity of the teachers, which will in turn improve the organization.

Leaders in schools take on various roles, but each person has a certain leadership style. Through taking leadership inventories, the researcher has been found to be a relational leader. Relational leaders are described as good two-way communicators who listen, provide encouragement, and involve their followers in the decision-making process (Hersey, 1985). Constant communication related to change or improvement occurs when you are a relational leader. Relational leaders also welcome feedback from their employees and treat this feedback as important dialogue between stakeholders who are trying to move the organization forward.

Regarding leadership in a time of change, Lewin (1947) discusses the stages an organization goes through when implementing change. The three stages that Lewin discusses are: unfreezing, change or transition, and then refreezing. Many organizations stay in one of the stages for a long time and an organization may go back and forth through the stages during one particular change or transition. The school that was studied is still getting out of the unfreezing stage and moving into the change or transition stage. Through observation, the researcher determined that 75 percent of the staff has moved out of the unfreezing stage related to online instructional tools, but not all staff has done this. Some staff members are still trying to unfreeze in relation to utilizing online instructional tools.

## **Chapter 3**

### **Methodology**

#### **Introduction**

This study examined the mental model shift of high school teachers regarding the change of instructional methods that have occurred because of the advent of online instructional tools. While examining teacher mental model shift, the actual change in instructional techniques was also examined. Qualitative methods were used to examine the perceptions teachers have about using online instructional tools in their classes. Some of the methods used to gather data were teacher interviews (Appendix A), teacher surveys (Appendix B), classroom observation (Appendix C), and lesson plan examination (Appendix D).

#### **Research Design**

This study is framed by the tenets of social constructivism, and examined everything in relation to how it fits into the greater world. This social constructivist perspective allowed the researcher to understand how participants in the study perceived the world around them (Creswell, 2007). The study analyzed a pattern of meaning from the participants (Crotty, 1998), who are members of a high school teaching staff who act in a social manner in many ways. Teachers who teach the same classes plan together, and socialize when they have prep time off during the school day. Teachers also discuss social plans they have together or with their families. Since this study examined how teachers plan and instruct students, there is a social aspect to this research (Creswell, 2007). Social constructivism, as a theory, allows for the interaction of teachers or other adults in the learning of students. Online instructional tools can be thought of as tools that

society has developed to assist students in their learning and development (Cole & Brune, 1992). Teachers were interviewed about their thoughts, related to how they interact with their students, which is a social construct in the classroom.

This study was also examined through the lens of a post-positivist worldview. This worldview augments the social constructivist perspective because this worldview allowed the researcher to explain the feelings (through mental models) of teachers related to their planning and instruction. The planning and instruction are known to be social interactions because the culture in the school and the interaction with students are both social interactions. Another way this worldview aligned with this research is a result of positivist theory discussing how the senses are essential in learning and development (Creswell, 2007). The use of online instructional tools certainly enhances the use of senses by students as they are being instructed. The use of social constructivist and positivist worldviews allowed the researcher to both understand and explain this research.

The research design for this study was qualitative. Qualitative research is the organized, systematic exploration of some kind of human experience (Creswell, 2009). A qualitative research design was chosen for the focus of this study because the purpose of the study was to analyze the mental model experiences of teachers related to planning and instructing with online instructional tools. In order to understand teachers' mental models, the researcher had to try and explain a human experience, so a qualitative design makes the most sense for this study.

The qualitative research consisted of rigorous data collection procedures. This study collected multiple forms of qualitative data. The researcher is considered an instrument of data collection since he is part of the high school community that was being

studied (Creswell, 2007). For this study, the teachers' views were the focus. The stories that the teachers tell will allow the reader to feel like he is present in the school, going through the same experiences as the teacher (Richardson, 1994).

The theoretical framework that was employed was grounded theory. Grounded theory method does not aim for the "truth," but instead aims to conceptualize what is going on by using empirical research (Glaser & Strauss, 1967). Grounded theory method allows researchers to retrospectively formulate new hypotheses to fit data. However, applying the grounded theory method, the researcher does not formulate the hypotheses in advance since preconceived hypotheses result in a theory that is not grounded in the data. The use of description in a theory generated by the grounded theory method is mainly to illustrate concepts (Glaser & Strauss, 1967).

The mental models theory framed this research. The grounded theory is that teachers will construct their plans and lessons dependent upon their mental models in education. Grounded theory research is a process of research where all of the subjects have been exposed to the same environment, but may have reacted differently to that environment (Creswell, 2007). All of the teachers who were interviewed, observed, and surveyed were exposed to the same environment at this high school and will have created mental models related to online instructional tools. The only difference among subjects is their experiences with the online instructional tools. These experiences and how teachers react to these experiences are at the crux of the research. If they have used online instructional tools in the past, then they will tend to use them again in their plans and their lessons. Before conducting research, the researcher thought that if teachers had positive mental models related to online instructional tools then they will be more apt to

use online instructional tools as a resource for instructing their students. This theory is supported by Inan and Lowther (2010), who found that teachers who have a positive view of computer technology are more apt to use computer technology in their classrooms.

This study had a research design that was qualitative in manner using an ethnographic strategy of inquiry. This study used a realist ethnography approach to answer the research questions (Creswell, 2007). This approach allowed the researcher to give an objective account of the mental model change situation teachers are going through in this technological environment. This approach led the researcher to be a reporter of the facts that were noticed when the interviews and observations were carried out in the field. Using an ethnographic approach also allowed the researcher to examine the culture of high school teachers and their use or non-use of online instructional tools.

Ethnography is defined as attempting to take a picture of people in their normal environment (Wolcott, 2008). The researcher in this study was trying to get a mental picture of high school teachers' mental model shift related to online instructional tools. Fetterman (1998) defines ethnography as the art and science of describing a group or a culture. Ethnographers are also taught to have an open mind regarding anything they may notice when researching their topic. When researching technology issues with people, you are not sure what you will get, so it is important to have an open mind (Capo & Orellana, 2011). This openness that is required of ethnography is a main reason why ethnography was chosen as the method of research. The particular group or culture that was studied is public high school teachers in a comprehensive high school in central New Jersey.

Ethnography can be thought of as a product of research or a research process (LeCompte & Schensul, 2010). An ethnographic study includes some historical data and paints a picture of people going about their normal business. The researchers embed themselves in the culture of the organization and report from that lens (LeCompte & Schensul, 2010). This researcher had no problem embedding himself in the research area, since he works in the school where he was conducting research. An ethnographic strategy allowed the researcher to ascertain what teachers go through when they plan and instruct using online instructional tools.

When conducting ethnographic research, it is important to have a background theory to gird your research (Fetterman, 1998). Cognitive theory was utilized as the binding theory for this study. This theory assumes that we can describe what people think by listening to them (Fetterman, 1998). Since the interviews were recorded, the interview protocol allowed the researcher to understand what the participants were thinking after he listened to and analyzed the interviews. The stories that related to online instructional tools were very important to this research.

Since this study is examining the mental model shift teachers are going through, there must be a focus related to what is going on in teachers' minds while they plan to instruct and actually instruct their students. The use of ethnographic research enabled the researcher to build on the perspectives of the teachers (LeCompte & Schensul, 2010). An ethnographic style of research allowed the researcher to embed himself into the teachers' culture and report on what was found. This study examined everything observed in teachers' classes related to online instructional tools (Wolcott, 2008). There were participant observation and open-ended interviews as part of this design (LeCompte &

Schensul, 2010). As the data were explored, there were findings related to answering the research questions.

There was a purposeful sequence to the data collection in this study. The researcher collected the interview data first, observed the teachers, and then examined the teachers' lesson plans over the past five years. Finally, there was an examination of the survey data from teachers at the high school that was being studied. This sequence allowed the researcher to use the qualitative data to inform the qualitative descriptive data that were found from the survey.

The interviews were conducted in a faculty conference room and were approximately 20 minutes long. The interviews were taped, and handwritten notes were taken to catch the essence of what the participants were saying during the interview. The interview questions focused on perceptions of online instructional tools, and how they have been or may be implemented in instructional situations in the teachers' classes (See Appendix A). The study probed for stories of how and why online instructional tools were being implemented. The interview questions also inquired about the feelings and opinions of teachers who were now using online instructional tools instead of traditional teaching instructional methods.

The classroom observations followed the teacher interviews and were conducted within one week of the interview. The observation form brought symmetry to every observation. The focus of the observations was to find out whether or not the teachers actually implemented the online instructional tools that they discussed in the interviews.

The inspection of the interviewees' lesson plans was conducted next. Careful notice was taken in looking at the instructional techniques that were to be used in the

lessons. This study also examined the resources the teachers were planning on using in the lessons. There was an examination of a sample of interviewees' lesson plans for the past five years. The six interviewees were asked to randomly select three lesson plans from each of the past five years. Therefore, the researcher examined a total of 90 lesson plans from the past five years. The instructional strategy was the focus of the examination of the lesson plans.

The examination of the teacher survey followed the observations (Appendix B). These data were collected from a majority of teachers at the high school studied. There were 200 teachers surveyed and 98 responded to the survey. Many of the questions on the survey were related to the use of iPads and computer technology. There were also many questions related to perceptions of the one-to-one iPad technology initiative. This survey was completely anonymous, which improves the validity of the survey (Taylor-Powell, 1996). However, there was a question on the survey related to the experience of teachers answering the survey, therefore the researcher could narrow down some of the participants to gain more information.

The qualitative data gained from the survey were analyzed using descriptive statistics to answer the research questions. When analyzing the survey data, the percentage of respondents answering questions leads to analysis, which is critical to the findings. The ability to query the survey results was utilized to notice certain demographic differences in the data. For instance, there was an examination of teaching experience in order to determine if it had an effect on the data. Using this ability to query the data assisted in making the findings more rigorous.

## **Data Sources**

The sampling method for this study was purposive. This strategy was utilized to obtain participants who would have a good knowledge of the culture being researched. These participants would also have the ability to describe the culture because of their positions as teachers (Horsburgh, 2003). The reason to engage in purposive sampling is to gain pertinent information from a small but knowledgeable sample of participants (McMillan & Schumacher, 2006). High school teachers were chosen from the academic areas of Science, Math, Social Studies, Language Arts, and Fine, Practical, and Performing Arts. These areas were selected because they are typically in every high school. The sampling of teachers in these academic areas made the study more transferable.

The setting for this study was a high school in the Middle Atlantic region of the United States of America. The interview and observation sample group was composed of six high school teachers from this high school. A small sample size is appropriate when using interviews as the main data point (Patton, 2002). This small sample size allowed the researcher to create a useful and credible study that could be conducted within available time and resources.

This high school is a comprehensive high school in a suburban location. There are approximately 2,000 students, 180 staff members, 1 Principal, and 3 Assistant Principals at the high school. The school's district factor group is an FG, which means that it is in an upper middle class demographic and also has a sending district (which sends about 200 students to the high school) that is a district factor group of a DE, which is a lower middle class demographic. The state of New Jersey sets these demographic groupings

and updates them every five years. Approximately 10 percent of the students receive free or reduced lunch. Approximately 15 percent of students have an individualized education plan and are therefore classified as special education students. Sixty-five percent of this high school's students attend four-year colleges.

During the past 10 years, this high school has undergone much change. In the mid-1990s the student population stayed around 1,000 students. However, by 2013 enrollment nearly doubled to 1,995. A whole school reform change, in the form of block scheduling, occurred in 1997. Initially, there was much debate from the staff whether or not to move forward with this new scheduling model. There are now four, 84-minute classes every day. The schedule is an A/B schedule, which alternates every day. This master schedule change was difficult in the beginning, but with a lot of professional development and training, the change has benefited our students and staff members alike. This schedule change was designed to help with college preparation because colleges follow a similar schedule.

The most recent change has been moving to a new high school building, which occurred during the 2011/2012 school year. At the same time the staff moved to the newly built high school, the administration also decided to deploy iPad learning devices to every student and staff member. This school is now in their second year of this iPad deployment, and the effect is mixed. Most teachers have found ways to utilize the iPad device in their classes. However, some teachers have decided to not use the iPad in their class except for occasional enrichment activities.

The researcher designed this study to fulfill the requirement of sufficiency and saturation of data from the interview process (Seidman, 2006). There were teachers who

were interviewed in various experience groupings, which allowed the researcher to generate findings related to experience levels. There were interviews of three high school teachers who have three to five years of experience, and three teachers who have more than five years of experience. These interviews were conducted during the spring of 2013. The different experience levels of teachers interviewed allowed the researcher to make comparisons from group to group for a richer data set (Miles & Huberman, 1994).

### **Data Collection**

The interviews and observations were conducted at the end of the 2012-2013 school year. The interviews and observations occurred in April and May 2013. The lesson plans were inspected in June of 2013. The survey was collected in April 2013, and then the data were analyzed from the interviews and survey in August and September 2013.

Since the qualitative study was ethnographic in nature, there was an examination of a culture of high school teachers who are transitioning to online instructional tools (Creswell, 2007). Observation of teachers in this culture was an important facet of data collection. This study had a goal of discerning the acceptance or appearance of acceptance of teachers using online instructional tools. This study examined a cultural theme of mental model shift from regular planning and instruction to using online instructional tools for planning and instruction (Wolcott, 2008). The patterns of what people do and say allowed the researcher to determine cultural influence on this topic (Spradley, 1980).

Argyris and Schön (1974) discuss espoused theories and theories in use, which bring more understanding to human action in social systems such as organizations.

Espoused theories are what people think will happen when certain circumstances occur. Theories in use are general characterizations of how theory applies to human interactions. For this study, the mental models that teachers possess when they decide whether or not to use online instructional tools are the theories Argyris and Schön discuss. For this study, the patterns of what the teachers say and do are the part of the “in- use” in the theories in use concept. Many people (teachers included) will just espouse a theory, when asked, and may not actually follow through and do what they say they are going to do.

Since interviews were a primary data point, there were many steps taken to create validity for the interview protocol. The interviews were recorded because the interviewees allowed the researcher to record the interview by signing a waiver form. This allowed the researcher to make sure that everything was heard during the interview. The researcher’s dissertation chair reviewed the interview protocol before any questions were asked of the interviewees (Seidman, 2006). All interview protocol best practices as outlined by ethnographic experts were followed during the interview process.

The qualitative survey data collection followed a data collection approach that follows steps generated from DeVellis (1991). These steps created rigorous quality research. DeVellis (1991) states that the researcher must first decide what to measure. Next, the researcher should create an item pool, using short items, at an appropriate reading level that allows the researcher to measure relevant data. Next, the researcher determines the scale of measurement for the items and the physical construction of the instrument. The researcher then has the items reviewed by the dissertation committee members. Next, the instrument is administered to a sample for validation. Then the items are evaluated using item-scale correlations, item variance, and reliability. After these

steps, the instrument is ready to be administered to the desired sample population (DeVellis, 1991).

This study followed most of the steps DeVellis (1991) recommends. There was a creation of an item pool of questions from an existing survey that was designed to answer the research questions. The questions were already scaled for measurement, and the physical format for the survey was set at survey origination. The researcher did not administer a sample of questions for validation, or use item-scale correlations or employ variance, because the questions were also utilized in other high schools to gain similar data from subjects. The questions were then administered to the desired population, which was the entire high school teaching staff.

The survey that was given was an effective way to gather descriptive data because the survey was given online and was therefore confidential, with no names needing to be given. The assumption was that participants would answer truthfully and honestly, which leads to accurate data. This survey provided baseline data that further informed the interviews that were given in the beginning of the study (Lincoln & Guba, 2000). The survey that was utilized has been given by various schools that have initiated a one-to-one iPad initiative. Apple Computer Corporation has used this survey in multiple schools that have integrated technology in their schools.

The examination of a selective sample of lesson plans from the interviewees was also conducted. The examination of the lesson plans was important to show any differences in the last five years of lesson plans. Lesson plans were examined to find out if teachers planned to use online instructional tools in the past in their classes, or if it has just been the last two years when the one-to-one iPad initiative was in place. A sample

lesson plan template is located in the appendix of this document (see Appendix D). Most of the lesson plans looked exactly like this template; however, 2 of the 6 teachers used a different template, which still included the same information.

After the interviews and observations of the six participants, the researcher asked for a sample of lesson plans from the last five years. The researcher requested at least three randomly selected lesson plans per year for the past five years. Since there were six teachers who were sharing three lesson plans from the past five years, there were a total of 90 lesson plans examined. The examination of instructional strategies was carried out in reference to these lesson plans. The researcher determined whether or not the teachers had planned to use online instructional tools in their classes. The lesson plans showed the instructional plans (including the strategies to be used) of the teacher.

The table below indicates the data that were examined from the lesson plans the teachers shared with the researcher (Appendix G). A sample of the lesson plan structure used by the teachers in this school is located in the appendix of this paper (see Appendix D).

Table 1

*Lesson Plan Examination*

Teacher, Year, and Number	Lesson Objective	Instructional Strategies
Teacher Number 1-6, school year of lesson, number of lesson	Take note of objective for lesson	Take note of instructional strategy used

During the research, ecological and external validity were created. The ecological validity made sure that the participants and setting were representative of the real world. External validity allowed the researcher to make generalizations of the findings. External validity also shows whether if this study were replicated, the same findings would be found (Metzloff, 1998). It may be hard to make global generalizations of this research because this study just researched one high school in central New Jersey. However, there will be transferability because there are similar teachers in subject matter and outlook in most high schools across the country.

Since the culture of teachers who are transitioning to using online instructional schools was examined, the teachers' behavior as they plan and instruct their students was also examined. These teachers' behaviors were observed in their everyday, natural environment (Genzuk, 2003). Detailed notes were taken when the observations took place. These anecdotal notes included such information as the brief description of the activity and lesson, the student groupings used, and a measurement of the technology and online instructional tools utilized during the lesson. A particular focus was observed in the notes related to the technology and online instructional tools usage.

These field notes and observation notes were used to create triangulation of the research (Miles & Huberman, 1994). The use of rich description of what was observed and the description of the culture was utilized in the field notes and observations. The rich description allowed the research to be more rigorous. The description of the culture of the teachers' and observation sites will also lead to a more rigorous study.

Four different data collection techniques were utilized to gain data for the study. Table 2 relates these techniques to the research questions.

Table 2

*Data Collection Techniques*

Research Question	Data Source 1	Data Source 2
<i>Research Question 1</i>		
How have high school teachers' mental models of preparation and instruction changed with the advent of online instructional tools?	Taped Semi-Structured Interview	Field notes from observation and material culture
<i>Research Question 2</i>		
What are the changes in actual practice of instructional methods related to teachers' use of online instructional tools?	Survey examination and analysis	Field notes from observation, lesson plan analysis, staff manual, other material culture

Since the researcher was embedded in this project, there was a careful awareness of bias. The researcher's views were expressed as part of the research so the reader knows the position of the researcher regarding the research (Miles & Huberman, 1994). The researcher was sure to show negative and discrepant information that ran counter to the researcher's thoughts on the research. When this research began, this high school was in year 2 of the iPad one-to-one initiative. When the research was concluded the high

school was in year 3 of the iPad one-to-one initiative. During this time, the researcher was an assistant principal at the high school being studied. The researcher was also a member of the one-to-one iPad initiative team with a focus on iPad deployment and return. The researcher was trained on many aspects of using the iPad as a learning device, and he has been receiving ongoing training that mirrors what the teachers in this school are receiving regarding implementing the iPad learning devices in their classrooms. The researcher has been using his iPad learning device for administrative tasks, which include using the student information system, conducting classroom observations, and collaborating with colleagues, parents, and students through email and other software programs.

Since the researcher is an Assistant Principal at the research sample site, he had to be aware of how the interviewees are influenced by him being the researcher and their assistant principal. The researcher explained the contextual shift to the staff members who were interviewed. Before the interview, the researcher explained to the staff members that he was not looking to change anything at the school because of this research. The staff members were told that he was not evaluating or judging them when they were being interviewed. The researcher interviewed only teachers who had already attained tenure status at the high school, because the researcher wanted to ensure that teachers did not just answer questions in the manner that they thought he would want them to answer as their Assistant Principal.

### **Instrumentation**

The main instrument that was used to gain qualitative data was a semi-structured interview. Since this study examined the mental models that teachers are using and

changing the stories that they told in the interviews were very important (Seidman, 2006). These interviews allowed the researcher to put the behaviors of the teachers' mental models into context.

An interview protocol was developed with main questions, follow up questions, and probes (Rubin & Rubin, 2005). The exact same questions were asked to every subject. All of these interviews were recorded so the researcher could go back and hear everything that was said in the interview and then move to code and theme the data. There were 10 main questions used to gain an understanding from the interviewee (see Appendix A).

Another qualitative data point was an observation of each of the interviewees while they were teaching their classes. Notes were taken regarding how they utilized online instructional tools. An observation tool was utilized to ensure the same aspects of the classes are being observed (see Appendix C). These observations helped find out if teachers were actually using the online instructional tools that they have discussed in their lesson plans. The observations helped answer the second research question, which is related to the actual change in instructional methods and their use of online instructional tools.

In order to acquire additional qualitative data regarding teachers' use of online instructional tools, a survey was given out to all teachers in April 2013, via a link in their email. The survey was given through the high school's computer software program via the high school's website, and teachers were asked to answer the survey by April 18, 2013. They were notified about the survey through an email from another assistant principal. The teachers were then given two weeks to answer the survey.

Field notes were collected, as were various documents from this high school. These documents were gathered to gain an understanding of this school (Creswell, 2007). Through the examination of these field notes and various school- and instruction-related documents, there was a greater understanding of the atmosphere of the school climate related to online instructional tools.

The documents and emails were collected to determine whether the administration supports the use of online instructional tools. The existence of the documents ensured that there was a dialogue between teachers and administrators related to online instructional tools in order to increase their usage. If there are documents and meetings regarding online instructional tools, then there is an assumption that a good environment exists to use online instructional tools. The lesson plans of the interviewed teachers were examined. The researcher asked for lesson plans over the past five years to determine if there were changes due to the advent of online instruction tools.

### **Data Analysis**

After the interviews were conducted, they had to be analyzed. In order to conduct data reduction, the interviews were coded and categorized (Miles & Huberman, 1994). The categories indicated to the researcher what was most important to the interviewees. Descriptive coding was used to answer the question, “What is going on here?” (Saldana, 2009). The transcriptions of the interviews were examined to discern words that gather the essence of the answers the interviewees shared. The researcher then recorded which words or concepts were used often and counted them to make categories out of the words that were noticed the most. These categories were then developed into themes of data, which informed findings and recommendations. These themes were compared to the

other data points from observations, field notes, and the data gleaned from the survey given to the teachers.

The first step in the descriptive coding process was to type key words noted in the interviews into a table in a document. After these key words were completed, a short list of codes was developed that could be used throughout the data analysis process of this study. These codes were then entered into another table in a document with columns, noting the frequency these codes were noticed in all aspects of research. There were also columns in the table noting the definition of the code, the category of the code, and specific examples from the interview with time stamps for further inspection if necessary. These codes were revised and updated throughout the data analysis portion of the research.

Below are the column titles that were utilized in the coding process of the interviews:

Code	Definitions	Category	Example from Interview	Quantity
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These headings were used to organize the data that were heard in the interviews with the teachers. The main categories were mental models and online instructional tools. The codes were developed from the words or concepts used often by the interviewees. The definition column was used to expand on the concept that was used for the code. The quantity column was added to show the amount of times the code or category was heard during the interview. The entire table used for coding is located in the appendix of this document (See Appendix D.)

After descriptive coding was complete for all interviews, observation field notes, and the researcher's field notes journal, pattern coding was employed. This type of coding allowed the researcher to discern patterns that were noticed during descriptive coding (Miles & Huberman, 1994). These pattern codes were developed after having accessed all of the data from the study and these patterns became clear after examining the transcriptions of the interviews and the notes from observations. The pattern codes were then entered into a table in a document with related data where the patterns were noted in the data analysis process.

Regarding the field notes, there were summaries written after each day of research. These summaries were examined in a manner similar to the interviews noted above. These summaries were completed to necessitate data reduction from the field notes, from observations in the classes, and other material culture data. There were codes set up for the data gained from the field notes, which were then developed into categories that came about after noticing the quantity of certain codes that occurred often in the field note collection process (Miles & Huberman, 1994). The more times a category and theme was noticed, the more the data led toward findings and recommendations.

The documents gathered throughout the research process were examined using data mapping techniques (Mills, 2003). This data mapping technique helped the researcher develop patterns from the documents gathered from the research. A search for documents occurred to inform the researcher about the change of instructional techniques, from traditional instructional methods to non-traditional online instructional methods. These documents gave the researcher this high school's outlook related to use of the newer methods.

There was little research related to data analysis of mental models. The research led the researcher to utilize data mapping as the data analysis method to determine the change in mental models of teachers examined in this study. In data mapping analysis, the researcher develops tables and reduces the data that is noticed in the different data collection methods in order to develop findings from the data. Three studies in particular led the researcher to choose data mapping (also called concept mapping) as the method to analyze the data gained from research for this study.

Kolkman, Kok, and van der Veen (2005) discussed mental model mapping in relation to decision-making in integrated water management. Even though the topic of study is different, the analysis of mental models used in their study is still applicable as a reference of how mental model change can be analyzed. In their study, Kolkman et al. used mental model data mapping to analyze the difficulties in decision-making on a cognitive level. They determined that data mapping is a quality instrument for revealing the reasoning behind the decisions that people make in organizations. The study of mental model change related to online instructional tools can be compared to Kolkman et al. because the researcher is analyzing the change in mental models instead of decision-making strategies.

A more general study related to data mapping was carried out by Jonassen, Strobel, and Gottdenker (2005). They examined model building for conceptual change. They determined, through their research, that model building is an excellent strategy to assess conceptual change in people because these models scaffold on top of each other, providing a representation of conceptual understanding and change. The study of mental model change as it relates to online instructional tools can be compared to Jonassen et al.

because the interview data, combined with observation and survey data, can be scaffolded to determine findings from the data collection.

There was one study that had both an educational topic and used data mapping to analyze mental models of teachers. Askill-Williams, Murray-Harvey, and Lawson (2007) examined teacher education students' reflections on how problem-based learning has changed their mental models about teaching and learning. These researchers identified words from their subjects' manuscripts that indicated changing mental models. They researched problem-based learning to determine what words, ideas, and concepts would indicate a conceptual framework of problem-based learning. Then the researchers pulled words, concepts, and ideas from the subjects' manuscripts to fit them into the table, which had the conceptual framework of problem-based learning. If the subjects used words, concepts, and ideas that are known to be part of the problem-based learning conceptual framework, then the subjects were found to have changed their mental model.

The method that the researcher used to determine whether mental model change occurred was to use the data mapping technique on the interview data. The researcher gathered data from the interviews and coded, categorized, and themed the interviews to make general mental model findings related to the data in the interviews. When the observation, lesson plan examination, and survey data were analyzed, there was a comparison of those data with the data mapping used for the interviews.

The lesson plans of interviewees were examined. Sample lesson plans were gathered from the past five years from the interviewees for the classes they have taught, in order to discern the types of instructional techniques. The instructional techniques were recorded in the researcher's field notes journal. The question of when online

instructional tools entered the lesson plans in the instructional strategies section of the lesson plans was examined.

The high school that was researched had just developed a Year 2 iPad expectations committee, while data were being compiled. This committee developed expectations that became part of a whole school action plan for school year 2012-2013. The teachers volunteered their input with the school administrators to develop the Year 2 iPad expectations. These expectations were used to assess whether or not teachers are using online instructional tools in an appropriate manner (see Appendix E). An analysis was conducted using the Year 2 iPad expectations document that was created by the committee. When observations and interviews were conducted, they were cross referenced with the Year 2 iPad expectations document to determine if the expectations are being met by staff members.

In order to analyze the qualitative data found, the data analysis spiral was utilized. The data analysis spiral moves from data management through to representation. The data analysis spiral allowed the researcher to move logically from one part of the research to the next part (Creswell, 2007). The other procedures in between data management and representation are: memoing, reading, interpreting, classifying, describing, and visualizing. The interpreting, classifying, describing, and visualizing phases of the spiral were completed many times, because further inspection yielded more rich analysis each time these phases were employed. Once this was completed, there was an account of the data that was comprehensive and fruitful that led to research findings. These phases were documented in the researcher's journal. Many of the different phases were utilized to arrive at the findings and recommendations.

There was a triangulation data analysis technique developed from interviews, documents, field notes, observations, and lesson plans. These qualitative methods were then merged with the findings from the survey qualitative portion of the study. The analysis findings from each data collection method were compared to each other to ensure triangulation of data (Mills, 2003). These triangulation data findings were then recorded in field notes and shared in the findings section of this study.

There was a comparison that was developed from the data gained from the different teachers who were studied. Since the teachers have some differences, there is an assumption that there will be some differences in the mental model shift regarding online instructional tools. The experience of the teachers who were interviewed and observed was examined to find unique data from these teachers. These pieces of data were noted and will be discussed in the findings section of this document.

The data from the survey were analyzed using descriptive statistics. Specifically, there were numeric counts and percentages used (Taylor-Powell, 1996). The variability of the findings from the teacher surveys depending on years of service was also examined. This variability was examined through multiple demographic indicators to determine if various groups had certain feelings towards iPads or online instructional tools.

The concept of causality was also discussed regarding the data found from the research. The variables gleaned from the data can have connections, which can be determined by analysis of that data (Miles & Huberman, 1994). When data points are analyzed after research, the researcher may notice that certain aspects of data cause teachers to utilize or not utilize online instructional tools. Causality can be determined

through mental models. Even though a teacher cannot enter a student's mind, they feel that they can "cause" learning to occur in a student (Strauss, 2001). Strauss argued that how teachers choose to instruct is related to their mental models of how learning takes place within a student.

Causal theory was used to explain the culture of teachers who struggle with changing their mental models regarding the use of online instructional tools in their classrooms. When data were gathered about the perceptions teachers have about using online instructional tools, the teachers were pressed about why they have certain thoughts about changing their instructional methods. Even though quantitative research is usually used to explain causality, this study used qualitative methods to try and understand what the teachers' mental models are when they plan and teach their classes (Anderson & Scott, 2012).

Donmoyer (2012) discussed the idea that when you have a preponderance of evidence in a qualitative study, you can infer that the evidence shows process causality and can be part of a researcher's analysis. This idea of preponderance of evidence was utilized when the qualitative data from the interviews and observations were analyzed. When teachers maintained their use of online instructional tools, and then the researcher verified their use, causality was said to have occurred regarding teachers' mental models and their subsequent instructional techniques.

An analysis to determine the mental model processes that caused teachers to utilize or not utilize online instructional tools was employed. There was also an analysis of the interviews to determine what mental model processes are used by teachers who do not integrate online instructional tools in their plans or class instruction.

The verification of the findings was drawn after data had been collected, displayed in tables, and reduced (Miles & Huberman, 1994). The qualitative findings may appear at different times in the data analysis spiral. When data were displayed in the qualitative analysis, the findings started to be noticed due to the frequency of concepts and categories. After initial analysis, it became apparent that the qualitative data findings related to the survey, which yielded descriptive statistics.

Further verification of findings occurred when the interview and observations qualitative findings were analyzed in conjunction with the survey qualitative findings. Since the initial qualitative data research was conducted before the survey qualitative research, the latter information was used as a measure to inform the initial qualitative findings. When the categories and concepts were noted in the initial qualitative data display and the survey qualitative analysis, it was determined that these findings were valid.

## **Chapter 4**

### **Findings**

#### **Introduction**

The mental model shift of high school teachers regarding the change of instructional methods that have occurred because of the advent of online tools was examined in this study. While examining teacher mental model shift, the actual change in instructional techniques was also examined. The findings were developed after examining the qualitative methods used in this study. These qualitative methods were used to examine the perceptions teachers have about using online instructional tools in their classes through teacher interviews, teacher survey, classroom observation, and lesson plan examination.

#### **Context of Study**

The data for this study were obtained from teachers at a high school in the Middle Atlantic Region of the United States of America. Interviews were conducted with six high school teachers and the researcher surveyed 180 high school teachers. Ninety-eight teachers responded to the survey. The teachers were interviewed and surveyed about their use of online instructional tools, iPad one-to-one initiative, and technology in their classrooms. The interviewees and respondents to the survey represented all academic areas of the high school: math, science, language arts, world language, social studies, special education, and fine and practical performing arts.

The six teachers were interviewed using a semi-structured interview. This interview protocol is located at the end of this document (see Appendix A). These six teachers were also observed conducting lessons in their classes. The observation form

that was utilized during the observations is located at the end of this document (see Appendix C). The teachers who were interviewed were randomly chosen from the tenured faculties of every department at the high school. The teaching experience of the interviewees ranged from six years of teaching experience to 24 years of teaching experience. There was one teacher with six years of experience, two teachers with 10 years of experience each, two teachers with 12 years of experience each, and one teacher with 24 years of teaching experience. See Table 3 for more information.

The teachers completed an online survey which was given through the high schools website (Appendix B). The highest percentages of respondents on the survey were from the math and special education departments, with 21% of the total respondents being from the math department and 21% of the total respondents being from the special education department. Nineteen percent of the respondents have been teaching between one and four years, 23% of the respondents have been teaching between five and nine years, 29% of the respondents have been teaching between 10 and 14 years, 12% of the respondents have been teaching between 15 and 20 years, and 17% of the respondents have been teaching for more than 20 years. See Table 1 for more information.

Table 3

*Teaching Experience of Interview and Survey Respondents (Years)*

	1-4	5-9	10-14	15-20	Greater than 20
Interviews and Observations, N-6	0	1	4	0	1
Survey Respondents, N-98	20	23	28	14	13

Interviews were tape recorded and then transcribed. The interviews were coded using the exploratory coding system (Creswell, 2007). This coding method allowed the researcher to examine recurring themes while exploring the answers. The exploratory coding system used descriptive coding data collection concepts (Saldana, 2009). Using the exploratory coding method also allowed the researcher to discern whether teachers' mental models have changed because of the advent of online instructional tools. This method helped the researcher assess each teacher's mental model through categories and codes. This exploration allowed the researcher to create a mental model that interviewees were using when they decided whether or not to use online instructional tools.

The same script was used for each interview. Each interviewee was told that the researcher was acting as a university researcher and not as their assistant principal. For the purposes of the interview, the researcher defined "online instructional tools" as the use of the iPad or Internet for classroom instruction. Two interviewees needed a reminder about the definition of online instructional tools during the actual interview. The interviews took between 15 and 20 minutes, and they were carried out in a faculty conference room.

Access was given by the high school's technology department to view the results of the survey on the computer network. Since the survey was given through the school's website service, the researcher was able to access the responses and generate percentages of responses. Results remained anonymous in the electronic survey. This anonymity ensured that teacher respondents answered truthfully because teachers would realize that anybody looking at the survey would not know the identity of the respondent.

In addition to the interviews and survey, there was an examination of many different types of material culture related to online instructional tools at the high school. Examples of material culture examined included professional development documents, Year 2 iPad observable expectations documents (Appendix E), and other related technology emails and memoranda. The training that was given and documented to the staff members was examined in detail. The breakdown of teachers who were trained often and turn-keyed their training was also examined. After the six teachers were interviewed, their lesson plans were examined to determine the change in instructional method over the past five years.

### **Mental Models Findings**

Four out of six of the interviews included concerns teachers had about rigor and using online instructional tools. Rigor is important to high school teachers because they are trying to create higher-level instruction for students' college readiness. These teachers understood that using technology was necessary in their instruction, but they were having a hard time convincing themselves that the change in going from traditional instructional tools to online instructional tools stayed at the same rigor level. Question 9 from the survey, which asked about the internal struggles teachers may experience when implementing online instructional tools, made teachers think about mental models they create when considering online instructional tools. One of the interviewees summed up her answer to question 9:

I find that I am asking myself the question of whether I am using the technology because the technology will improve my instruction or am I using the technology because I work in a high school with a one-to-one iPad technology initiative.

The fact that the teacher survey shows that high percentages of staff members are using their iPads more for instruction leads the researcher to believe that teachers are getting better at creating rigorous activities using online instructional tools. The survey showed that 64 percent of responders said that they used their iPads more than last year (Table 4).

Table 4

*iPad usage - Change from school year 2011/2012 to school year 2012/2013 (N=98)*

	Quantity
More than last year	62 / 64%
The same as last year	28 / 29%

Since all of the data collection was at a high school that has instituted a one-to-one iPad technology initiative, it is important to mention that the administration is challenging teachers at this high school to use the iPads as part of their instruction in some capacity. The administration is challenging teachers to not only use the iPads as a replacement tool for what teachers did before the iPads, but to use the iPads to create highly rigorous activities and assignments. The administration has asked teachers who are early adopters to share their uses of online instructional tools. The environment in which these teachers are now teaching in relation to technology integration definitely influences the use of online instructional tools. Three teachers said in their interviews that they are aware that the high school and school district administration want them to use the iPads and online instructional tools in their classroom instruction.

Teachers have been shown the SAMR model developed by Ruben Puentedura (2009), which defines different levels of technology integration. As you move up the SAMR model, the level of rigor regarding the technology application increases. The lowest level is replacement and then moves to augmentation, then to modification and finally redefinition of instruction given by the teacher. The replacement level technology integration occurs when teachers use technology as a direct tool substitute with no functional improvement. Augmentation occurs when teachers use technology as a direct substitute with functional improvement. Modification occurs when teachers use technology to allow for a significant task redesign. Redefinition occurs when teachers use technology to allow for the creation of new tasks, which were previously inconceivable. These higher levels of integrations at augmentation, modification, and redefinition are starting to be noticed at this high school, and inevitably the higher the level of technology integration, the more rigorous the activity, assignment, or instruction is to the students.

Another consistent finding was that teachers realized that online instructional tools and technology are vital instructional tools and students need to use them to be competitive in today's society. Two teachers said in their interview that as recently as a few years ago they had negative attitudes toward online instructional tools, but have changed their feelings within the last two years. These changed feelings had an important impact on these teachers' mental models related to online instructional tools. Five teachers commented they noticed that students like using the online instructional tools. These teachers also said that since students like using the online instructional tools, they are more motivated to learn the material. All teachers interviewed also stated that online

instructional tools prepare students for the future of learning in a technologically-integrated society.

This finding that teachers realize that online instructional tools are vital for student learning was surprising to the researcher. Even though two teachers said in their interviews that they had initial difficulty implementing online instructional tools, overall the teachers who were interviewed and observed did not have much difficulty with implementing online instructional tools. In fact, 4 of the 6 interviewed said that after professional development and practice with their colleagues they enjoyed implementing these tools and felt good about the process of implementing online instructional tools.

Four teachers said in their interviews that they could keep their instruction relevant and contemporary much more easily because of online instructional tools. These comments show that teachers feel that the technological tools the students have access to is leading teachers to create more rich and relevant learning activities for their students. On question 11 in the survey, 43% of teachers said they were able to engage students in more difficult content because of the use of the iPads and online instructional tools.

The researcher noticed another positive response when examining question 8 on the survey about teachers' feelings regarding their preparation. Sixty-three percent of teachers responded that they were either very well prepared or moderately well prepared for using the iPad for classroom instruction. This response indicates that the professional development plan and teacher acceptance of the one-to-one iPad technology initiative have been effective.

Question 9 in the interview dealt with the internal struggles some teachers have when implementing online instructional tools in their classes. Only 1 out of 6 teachers

interviewed said that they had internal struggles when considering implementing online instructional tools. This question was asked to develop where the teachers' mental model resided when the teacher was interviewed. Since the teachers were interviewed at the end of Year 2 of the iPad one-to-one initiative, the teachers interviewed had become used to using online instructional tools. Because 5 out of the 6 teachers interviewed did not have internal struggles with using online instructional tools, they were determined to have a positive mental model regarding the use of online instructional tools in their classes.

Four out of six teachers stated in their interviews that they have noticed a change in their attitude toward using online instructional tools in their classes in the past two years. These 4 teachers said that they used to have reservations using online instructional tools, but they now realize the benefits of these tools and use them regularly in their classes. Related to this finding, were the statements by all of the interviewees who said they now feel comfortable using online instructional tools in their classes.

There was some positive feedback that developed from examining the survey given to teachers. For instance, 50% of teachers responded that the iPad technology initiative has allowed them to better meet the needs of students with individual needs (for example, low achieving or "gifted students"). This ability to potentially differentiate instruction to assist students is essential to administering high-level instruction to students. Sixty-two percent of teachers also responded that they are able to make their content more relevant to students' lives because of the iPad technology initiative. Since data show that teachers can make their content more relative to students, the researcher believes that teachers can be more creative with how they engage students in their classes because the students have access to the iPads and online instructional tools. The survey

showed that 65% of teachers responded that the quality of products created by students has increased as a result of the one-to-one iPad technology initiative. This makes sense because all students now have an advanced piece of technology at their disposal to create interesting and creative projects. Since the students have the iPads they have been asked to create more products, which has led to improved quality in these products. These positive feelings and perceptions of technology led the researcher to believe the mental models teachers have related to online instructional tools are improving.

The coding process of the interviews led the researcher to determine that a teacher mental model change related to online instructional tools occurred during the past two years. Table 5 shows some of the coding that led the researcher to this conclusion (see Appendix F).

Table 5

*Coding for Mental Model Change*

Code	Definition	Category	Examples in Interview	Quantity
Internal Struggle with Online Instructional Tools	Teacher decision regarding online instructional tool usage	Mental Model	Am I doing this for better student learning or because we now have iPads?	5
Rigor	Difficulty of assignments to engage learners	Mental Model	Are online instructional tools as rigorous as traditional instructional tools?	9
Change in perception of online instructional tools	Teacher thoughts about online instructional tools	Mental Model	2 years ago I thought online instructional tools were not necessary for quality instruction; now I do.	10
Use of online instructional tools now, not before	Application of online instructional tools	Mental Model	I feel more comfortable now using online instructional tools than I did 2 years ago.	11

The interviews, observations, and survey were completed during Year 2 of the iPad one-to-one technology integration at this Middle Atlantic High School. During the year of this research, the researcher led a committee of teachers in this high school whose goal was to develop a Year 2 iPad observable expectations document that would guide teachers. The committee was made up of teachers who volunteered to be on the committee and was comprised of at least one teacher in each department. This committee and ensuing document challenged the mental models (related to online instructional tools) that teachers may have had prior to the Year 2 iPad committee meeting and creating the observable expectations document. The teachers felt challenged, because with the creation of this committee, teachers realized that adding the iPad to their instruction was going to be expected by the school administration. This Year 2 iPad observable expectations document can be viewed in the appendix of this dissertation (Appendix E). Teachers who were supportive of the one-to-one initiative, as well as those who were critical, served on the Year 2 iPad observable expectations committee. When the researcher was interviewing, surveying, and observing teachers at the end of school year 2012/2013, he noticed that there was a change in perception and attitude (which affect mental models) toward the one-to-one iPad initiative. The researcher could notice that teachers, students, and administrators were more comfortable working in a one-to-one iPad environment.

After analyzing the interviews, observations, surveys, and material culture there is a conclusion that an overall teacher mental model change occurred at this high school in the last two years, which allowed positive thoughts and perceptions of online instructional tools. This mental model change made teachers believe in the positive

qualities of online instructional tools and therefore led to more usage of online instructional tools in teachers' classes. When 62% of teachers surveyed said that the one-to-one iPad initiative allowed them to make content more relevant to students' lives, the researcher concluded that there was a positive mental model change (Table 6).

Table 6

*Change in Teacher's Instruction as a Result of one-to-one iPad Initiative (N=98)*

	Strongly Agree	Agree
Students can more easily copy work and turn it in as their own	41 / 46%	32 / 36%
iPads distract students from doing work assigned to them	43 / 48%	32 / 36%
I am better able to meet the needs of students with individual needs	12 / 14%	33 / 37%
I am able to make content more relevant to students	10 / 11%	45 / 51%

### **Teacher Practice Findings**

Through interviews, observations, and survey examination, the researcher noticed that almost every teacher interviewed and observed used online instructional tools to dispense and collect assignments from students in some capacity. When discussing the processes that teachers use to disseminate information to students and obtain feedback from students, some teachers expressed difficulty about the workflow process. Because the researcher is an assistant principal in the building where the interviews and observations were taking place, the researcher heard about some of these workflow issues. The teachers said that they realize how effective using online instructional tools

would be once the workflow issues were ironed out. After school year 2012/2013, there have been multiple steps taken by the technology team at this high school to alleviate the workflow issues that plagued the teachers and students the first two years of implementation of the one-to-one iPad initiative.

The high school that was studied started a one-to-one iPad technology initiative in the fall of 2011. At the beginning of the 2012 school year the administration and teaching staff developed a school goal that said that every teacher would create a wiki to facilitate collaboration between teachers and students. Every teacher that was interviewed mentioned their wiki in some capacity in their answers to the interview questions. Four out of the six teachers interviewed said that the wiki improved their instruction. A few teachers said that the wiki allowed the teacher to get the students to access information more quickly than handing out documents. Other teachers said the wiki was convenient for students to access when they were absent or at home studying or doing homework. Another teacher responded in the interview that having all of the resources on the wiki allowed for more time for differentiated instruction, because students could access different resources at the same time.

It was noticed in interviews, observations, and survey examination that teachers used their wikis to create warm-up activities, access and complete lesson activities, and access and complete assessment activities. Interviewees also stated that they used the wiki online instructional tool effectively as a notification of missed lessons, activities, and assignments when students were absent from school. Teachers said that using these digital documents and lessons allowed the students to catch up if they fell behind because of attendance or other reasons.

The wikis come in many different formats. Most teachers were using a format from an online company called “pbworks.” The rest of the teachers were using a wiki format that was provided by the school district to work off of the school district’s computer network. Other teachers were using a different format. However, all of the teachers were using the wiki for the same purpose of sharing and collaborating class information, and as a place to put online instructional tools so students can access them anywhere they have an Internet connection.

When interviewing and observing teachers, the researcher found that 3 of the 6 teachers were experimenting with “flipping” their classrooms by giving assignments to students to complete at home and then using those assignments as a starting point for the next class. The science and social studies teachers had tried this method many times during the past two school years. Both teachers mentioned that there were positive student outcomes that occurred after “flipping” the classroom. Both teachers also said that the “flipped” classroom concept tended to work more effectively when used with the honors or advanced placement level students, meaning that the students who were taking more difficult classes tended to have better responsibility to complete the assignment at home before coming to class, allowing the “flipped” process to be more effective. It was noticed in the interviews and observations that teachers used their wiki to facilitate their “flipped classrooms.”

One finding noted after examining teacher interviews was the fact that 4 out of 6 teachers discussed using online instructional tools to enhance the ability to have a “teachable moment.” Teachers said that using the Internet and/or online instructional tools allowed them to instantly access interesting and relevant information related to their

classes. This “real time” access to information was definitely determined to be a positive aspect of incorporating online instructional tools into daily instruction. One teacher said that he and his students were discussing a certain company in their discussion about stock markets, and he was able to have students retrieve real-time stock prices. In the past, the teacher said he would have had to bring in newspapers to show stock prices and maybe would have had to show a movie or film clip. Now the students can access various online instructional tools to supplement his lesson about stock markets. Other teachers that were interviewed and observed said that they used the online video software “You Tube” at various times in their classes. Four out of six teachers that were interviewed and observed also said that there are many times in their classes when they tell their students to “Google it,” in order to find more information from the Google Internet search engine. This saying led the researcher to believe that teachers want students to use online search engines to find out answers to their questions by themselves, which enables students to become independent learners. These observations were impressive because the researcher noticed students taking ownership for their own learning, something for which educators have always strived to achieve when teaching students.

When the researcher was observing the interviewees’ classes, he noticed that all of the teachers used or discussed their wiki page at some point during the observation. Two of the teachers had their students actually go onto the wiki page to obtain the assignment for the day. Another three of the teachers told students that there were extra resources on the wiki page that would enhance the students’ learning if they needed extra help on a topic of the lesson. One teacher used the wiki to show a slide show that the students could access later if they had questions about the lesson. There was also one

teacher who used a response system application to measure the prior learning of her students. Table 7 shows the data collected from the observations of the interviewees' classes (also Appendix H).

Table 7

*Teacher Technology Use and Application*

Teacher	Tech Used	How tech was used
1	Internet, wiki	“Teachable moment”; to obtain assignment
2	Wiki	Teacher retrieved slide show from wiki
3	wiki, Internet	Told students about extra resources, “Teachable moment”
4	wiki, response system	To obtain assignment, to measure prior learning
5	wiki, Internet	Extra resources, “Teachable moment”
6	Wiki	Extra resources, “Teachable moment”

This ability to create unique learning environments because of online instructional tools, led some teachers to discuss differentiating the instruction to their students. Two teachers discussed the use of online instructional tools to individualize their students' learning. These teachers said that technology made it easier to differentiate because they could direct students to a particular online instructional tool and let them work on their learning at their own pace. The survey showed that 51% of teachers responded that the iPads allowed them to meet the needs of students with individual needs. Since teachers have access to multiple online instructional tools (such as applications and digital

textbooks), they can cater the tools to make the instruction applicable to students with varying ranges of ability and aptitude.

There was one major finding that surfaced in interviews and observations that had negative implications for online instructional tools. Two teachers said that students who are not mature or who have some attention problems may get drawn off task when using technology, because there are many different things that students could be doing instead of the intended activity on the technology devices. A similar finding was that two of the teachers who were interviewed said that sometimes students try to play video games on their iPads instead of doing the intended activity with the iPad. When the researcher was observing these teachers, he did not notice that students were off task on their iPads. The researcher also did not notice any students playing games on their iPads when he was observing teachers. Even though the researcher did not notice this negative behavior, he must assume that this behavior has happened because the teachers said in their interviews that it has happened. There is a possibility that students did not fool around with the iPads during the observations because the researcher, who is an assistant principal, was in the classroom.

In a related finding, two teachers said in their interviews that some students get caught up in the vast world of the Internet, and that these students have difficulty finding appropriate information when using online instructional tools. Often when working with technology, one must filter through extraneous information. The two teachers noted that if students are not careful, they could even find inappropriate or illegal information using the Internet or online instructional tools. These teachers went on to say that even students with the best intentions could be thrown off track if they are not careful. Table 8 shows a

sample of the data map used to develop findings from the teacher interviews related to online instructional tools.

Table 8

*Sample of Data Map*

Code	Definition	Category	Examples in Interviews
Disadvantages of online instructional tools	Negative thoughts of online instructional tools	online instructional tools	Internet is so vast that students must be critical of the information they find on the Internet
Advantages of online instructional tools	Positive thoughts related to online instructional tools	online instructional tools	Great, getting students ready for learning in the future
Uses of online instructional tools	Application of online instructional tools	online instructional tools	Students can see models of labs and exemplars of labs and problems, Projects
wiki, “Google it”	Teacher application of online instructional tools	online instructional tools	Asking students to “Google it” enhances “teachable moment”; course outline is on WIKI for students

Regarding use of the iPads, question number 1 of the survey asked teachers how often they use the iPad for various tasks. When examining the survey given to teachers, it was noted that more than 80% of teachers used their iPads to post schedules, assignments, or related resources for student use at least once a week. These data are shown in Table 9. This table demonstrates there is a significant portion of the teaching staff who have embraced the one-to-one technology initiative. The same question also indicated that 63% of teachers create digital media presentations using their iPads at least once a week. Table 9 shows teachers are using their iPads for various presentations

during the school year. In a related question, 64% of teachers responded that they have used their iPads more of the time when compared to last year. These statistics reveal that almost two-thirds of the teachers at the high school are using their iPads more this year than last year, which suggests that teachers are becoming more comfortable with the one-to-one technology initiative.

Table 9

*Teacher Technology Usage (N=98)*

	Daily	1-4 times a week	1-4 times a month
Post assignments, schedules for student use	49 / 50%	29 / 30%	10 / 10%
Create digital media presentations	17 / 17%	28 / 29%	31 / 32%
Maintain and access administrative records	91 / 93%	5 / 5%	1 / 1%

After examining the teacher survey, some negative feedback was apparent. For instance, 80% of teachers responded that students can more easily copy work and turn it in as their own as a result of the iPad technology initiative. These data are shown in Table 6. This finding is interpreted as relevant even though no teacher mentioned cheating as a concern when asked in the interviews. Even though there may not be more cheating, the perception that it is easier to cheat puts teachers on notice to utilize the technology carefully when assessing students. Another finding that has a negative connotation is that 80% of teachers responded that iPads can distract students from doing work assigned to them. Related to this, there were 72% of teachers who responded that iPads encourage

unauthorized uses of technology. During the interview process 2 out of 6 teachers said that the iPads, or online instructional tools, can be a distraction for some students. However, there have always been other distractions in the past, such as passing notes or students talking with their neighbors. The iPad initiative and online instructional tools have the perception of potentially taking students away from work they should be doing for their classes.

Table 6 also reinforces a finding from the teacher interviews. As noted earlier, 4 out of 6 teachers said that they could keep their instruction relevant and contemporary more easily with the advent of online instructional tools. The survey analysis showed that 51% of teachers responded that they are better able to meet the needs of students with individual needs. The survey analysis also shows that 62% of teachers responded that they are able to make content more relevant to students as a result of the one-to-one iPad initiative. These feelings led teachers to create positive mental models related to online instructional tools.

There were some differences in the survey responses depending on the experience level of the teachers completing the survey. The researcher thought teachers with more teaching experience would think that students would be able to copy or cheat more easily because of the online instructional tools. Teachers with 5-9 years of experience (as can be seen in Tables 10 and 11) are more concerned about students copying work as a result of using online instructional tools. This contradicts the researcher's initial opinion. Teachers with 5-9 years of experience and more than 25 years of experience both thought that iPads distract students from doing work assigned to them, as can be seen in Tables 10 and 11. Both groups of teachers had equal agreement when asked about being able to meet

the individual needs of students as a result of iPad use. These groups of teachers also had similar thoughts about students being confused with finding information on the Internet and understanding of that information.

Table 10

*Change in Teacher's Instruction as a Result of one-to-one iPad initiative, Teaching Experience 5-7 years (N=18)*

	Strongly Agree	Agree
Students can more easily copy work and turn it in as their own.	11 / 61%	4 / 22%
iPads distract students from doing work assigned to them.	10 / 56%	8 / 44%
I am better able to meet the needs of students with individual needs.	4 / 22%	3 / 17%
Students confuse finding information about topic on Internet with understanding of that topic.	10 / 56%	6 / 33%

Table 11

*Change in Teacher's Instruction as a Result of one-to-one iPad Initiative, Teaching Experience of 25 Years or Greater (N=9)*

	Strongly Agree	Agree
Students can more easily copy work and turn it in as their own.	4 / 44%	4 / 44%
iPads distract students from doing work assigned to them.	5 / 56%	2 / 22%
I am better able to meet the needs of students with individual needs.	2 / 22%	2 / 22%
Students confuse finding information about topic on Internet with understanding of that topic.	4 / 44%	2 / 22%

When analyzing interviewees' lesson plans, it was noticed that there was more use of online instructional tools in recent year's lesson plans than there were on the lesson plans from five years ago. When examining teachers' lesson plans, it was noticed that three years ago there started to be some significant documentation of online instructional tools and technology use in the lesson plans. The lesson plans from five years ago only had a few lesson plans where online instructional tools were noted as a method of delivering instruction.

After closely examining the interviewees' lesson plans, it was noticed that there was an increase in the usage of online instructional tools in the lesson planning each year. The first year that was examined was 2008, and there were 3 out of 18 lessons that had instructional plans that included online instructional tools. The second year of 2009 had 4 out of 18 lessons that had instructional plans that included online instructional tools. The third year of 2010 had 5 out of 18 lessons that planned to use online instructional tools. The fourth year, which coincided with the one-to-one iPad initiative, had an increase to 8 out of 18 lessons that had instructional plans that included online instructional tools. The last year that was examined, which was Year 2 of the one-to-one iPad initiative, had 10 out of 18 lessons that had instructional plans that included online instructional tools. These data showed that teachers started planning to use more online instructional tools when their mental model started to change in recent years.

The lesson plan findings data analysis format can be located in Table 12. This sample table shows two of the teachers' whose lesson plans were examined. The complete table can be found in Appendix G.

Table 12

*Lesson Plan Examination*

Teacher, Year, Number	Lesson Objective	Online Instructional Strategies?
Teacher Number 1-6, school year of lesson, number lesson examined	Take note of objective for lesson	Online instructional tool planned?
Teacher 1, 2012, 1	Review Unit 6	Yes
Teacher 2, 2011, 3	Introduce Unit 4	No

**Findings Connected to Relevant Literature**

Survey analysis shows that 64% of teachers responded that students and teachers are using their iPads more during the second year of the one-to-one iPad technology initiative. This finding matches some of the literature reviewed earlier. Interviews showed that teachers felt more positive related to the one-to-one iPad technology initiative in Year 2 because they said that they used the iPads and online instructional tools more in Year 2. Inan and Lowther (2010) found that teachers who have a positive view of technology would be more apt to use technology in their classes for activities and instruction. The idea that when teachers have a positive view of a piece of technology they will use it more in their classrooms definitely showed through in this research. The finding gleaned from the interviews of teachers suggests that they now realize that technology is part of our future. These teachers understand the fact that they must use technology in order to teach their students effectively in a twenty-first century classroom. This change in teachers' mental models can be related to Wang (2002) when he discussed that teachers must be comfortable with the change in order for the change to be effective.

The two year elapsed time on this one-to-one technology change in this high school has contributed to the increased comfort level of teachers related to online instructional tools.

The tools that teachers discussed in their interviews were also congruent with some of the literature noted earlier. When Revere and Kovach (2011) discussed teachers beginning to use online instructional tools such as wikis and online response ware systems, their research mirrored what was found from the interviews and observations of teachers conducted in 2013. In the interviews, teachers discussed what tools they used and how they felt about using those tools. All of the teachers interviewed used some of the online instructional tools in some capacity. The use of these tools in classes was noticed during the teacher observations.

Since teachers have noted that they are now having better experiences with the online instructional tools, their mental models related to online instructional tools have changed into positive mental models. Two teachers said in their interviews that before Year 2 that they did not have positive online instructional tools mental models. When Johnson-Laird et al. (1998) discussed how mental models are created from people's experiences, the researcher connected this thought with the changes teachers explained in their interviews when moving from Year 1 to Year 2 of the iPad one-to-one initiative. The teachers interviewed had definitely changed their perceptions and mental models of online instructional tools as evidenced by implementation in their classes.

Table 4 shows teachers' increased use of computer technology in their classrooms. When comparing activities that were planned to be carried out in lessons, there were more references to online instructional tools in lesson plans that were completed in 2010, 2011, and 2012 than in the lesson plans from 2008 and 2009. These

changes in planned activities support the finding that mental models changed in the last few years.

In the literature review, the researcher discussed how Webley (2012) researched the concept of a “flipped classroom.” When interviewing and observing teachers for this study, the researcher noted several instances where parts of the “flipped classroom” were being used. The teachers who were interviewed and observed using the “flipped classroom” concepts mentioned in their interviews that the students were more motivated and engaged in the learning process when “flipped classroom” instructional concepts were utilized. Teachers responded in their interviews that even when some students did not complete the initial assignment the night before (which is what is supposed to happen), the teacher was able to catch them up more quickly because many students were able to move on to other activities because they had done the initial learning the night before class. This process allowed for more one on one instruction with the students who struggled or did not complete the initial assignment.

### **Findings Related to Methodology**

The interviews were essential in highlighting the mental models and perceptions that teachers had related to online instructional tools. Teachers were able to explain their feelings towards using online instructional tools in the past and how they have changed their views towards these tools in the past few years. The most unique finding that came out of these interviews was related to the teachers noting that they were concerned about the rigor level that they could reach while using the online instructional tools. Some of the teachers thought that the traditional ways that they instructed students were more rigorous than using online instructional tools. However, these teachers also noted that

they realized that they had to use online instructional tools because it was important to use contemporary tools and methods that motivated students.

The survey that was given to the teachers allowed the researcher to gather descriptive qualitative data that were used to inform the qualitative data that were previously collected through teacher interviews. These data allowed the researcher to quantify the thoughts that were expressed by the teachers in their interviews. Some of the findings from the interviews were able to be aligned with some of the findings from the survey data. When teachers told the researcher in the interviews that they were using the iPads in their classes for various instructional methods, he was able to corroborate that finding with the data from the survey which noted that 80% of teachers use the iPads for activities or assignments at least a few times every week. Another finding that was corroborated through the online survey that was given to teachers was in relation to students sometimes being distracted by using the iPads. Teachers said student distraction caused by iPads was a small problem in their interviews, but in the survey it was noticed that 80% of teachers responded that they either strongly agreed or agreed that iPads distract students from doing the work assigned to them.

The observation data allowed the researcher to determine if what the teachers said in their interviews was actually occurring in their classes. Observing the interviewees allowed for verification of their initial claims of how they use online instructional tools. The observations allowed the researcher to verify whether what the teachers said in the interviews actually happened in the teachers' classes.

## **Insights**

The researcher found that teachers realize that they need to embrace instructional technology for many reasons. Three teachers said in their interviews that the online instructional tools motivated their students more effectively than other instructional methods that were used in the past. Three teachers also said in their interviews that students need to learn how to use online instructional tools because these students would be asked to use them when they go on to college and the workplace.

The finding that teachers will incorporate technology into their lessons if they feel comfortable with the technology themselves was found in both the interviews and the survey given to teachers. Since teachers have said in their interviews and showed during their observations that they are more comfortable with using online instructional tools, the conclusion is that teachers will utilize online instructional tools more often in their classes.

Triangulation was gained in data analysis of interviews, surveys, and observations. It was noticed in the interview process that teachers' attitudes and mental models have changed in the last few years related to implementing online instructional tools in their classes. This finding was supported by analyzing the survey that showed teachers were in fact using online instructional tools more often than they had in the past. When he observed the interviewees' classrooms, the researcher was able to find that teachers were using online instructional tools.

The most significant finding was that teachers have changed their mental models in a positive way and this change has led to teachers using online instructional tools more often in their classes. In the past two years, teachers at this high school have moved from

being critical of using online instructional tools to using them in many different ways in their classrooms.

## Chapter 5

### Implications for Policy, Practice, and Future Research

We live in a world where technology is all around us and affects us in every facet of life. Often, schools are behind when it comes to mirroring changes that occur in society. The purpose of this research was to find out if teachers' mental models have changed regarding the use of online instructional tools. This study also examined the actual change in practice that has occurred in teacher's usage of online instructional tools. In order to research these topics, two research questions were examined:

- How have high school teacher's mental models of preparation and instruction changed with the advent of online instructional tools?
- What are the changes in actual practice of instructional methods related to teacher's use of online instructional tools?

The high school in this research study has been attempting to stay on the cutting edge of technology. This high school has encouraged teachers to use online instructional tools during instruction by instituting a one-to-one iPad environment that has transformed this school in many ways.

One observation that was noticed as a result of this research was that online instructional tools allow teachers and students to enhance their learning because they can access the Internet or other technology tools at any time during the day. This study focuses on how teachers' perceptions and mental models impact the use of online instructional tools. This research suggests that a year or two of having a one-to-one iPad

initiative will create positive mental models of technology and will therefore utilize online instructional tools as instructional tools in their classrooms.

The research that was conducted is important because technology has become increasingly present in education. Starting in 2014, the New Jersey state government is going to be assessing students online instead of using pencil and paper tests. Technology is also viewed as important to the future quality of education because of the advent of online classes at the secondary and college level of education and the use of the Internet to search for information. Many parents, teachers, and students will use Internet search engines to find information on various topics they want to learn more about, whereas in the past, books or other paper medium were used for this purpose.

The researcher feels that this research achieved the goals that were set when the research began. When the research began, the researcher was trying to peer into the minds of high school teachers to realize what they are thinking when they decide whether or not to use online instructional tools to instruct their students. The interview process accomplished this goal while the survey, observations, lesson plan review, and analyzing material culture, shed more light on the mental models of teachers and the actual use of online instructional tools in the classroom.

This chapter will address each research question with recommendations for future research related to each research question. The next section is a discussion of the change process that teachers are going through related to online instructional tools. The final section will address relevant leadership theories that impacted the researcher as a result of this study.

## **Mental Models**

The first research question related to how teachers' mental models had changed because of the advent of online instructional tools. The interviews that were administered led the researcher to findings related to mental models. Since the teaching staff at the high school that was researched was in the second year of a one-to-one iPad initiative, the mental models were changing during the time the research was taking place. During these interviews, the researcher could notice that teachers realized that in the past few years, they had changed the way they thought about planning and instructing using online instructional tools.

When interviewing teachers about their thoughts related to online instructional tools, the researcher found that teachers wanted to use online instructional tools, but there were some perceived roadblocks. The main concern teachers expressed was the concern that online instructional tools lacked the rigor that existed in traditional instructional techniques. Teachers were also concerned that students who were not mature enough to learn on their own would play games, or use the technology for a different purpose than intended. Even though there were those concerns, most teachers said they would use online instructional tools in their classes.

One implication is that administrators should allow time for a mental model change to occur when moving to a new initiative. This high school is now in Year 3 of the one-to-one iPad technology initiative and there have been many different types of professional development offered to teachers during the phasing in of this program. Even with all of this professional development, there are still teachers who require more assistance with using online instructional tools. The process of using online instructional

tools in classes is an ongoing proposition. The acceptance that change is the norm, because the actual online instructional tools change often, and the implementation actions of using the tools also change often.

### **Changes in Actual Practice**

The second research question asked was the following: What changes in actual instructional practice occurred as a result of the increased use of online instructional tools? The teacher survey and class observations led to most of the findings. The researcher found that teachers had not changed much in their methods, but they had changed the vehicle with which they instructed their students.

Starting in the 2014-2015 school year, the state standardized testing in New Jersey will be given on computers. The school that was researched will be ahead of many other schools, because their staff and students have experience using iPads, which they can use for their standardized tests. This Partnership for Assessment of Readiness for College and Careers (PARCC) testing of national common core standards will be mandated for all schools in the state of New Jersey. There have been concerns from many school districts that students and staff members will not be comfortable using computers for tests. This high school will be at an advantage when these tests arrive because the students and staff members will be used to using their iPads for all types of school activities, including tests.

The implications for the students and staff members related to online instructional tools will be positive for the staff and students because society will continue to use online tools in many ways. Almost everybody has a smart phone or mobile device that connects

to the Internet. People are using these devices more and more for everything they do in their lives. Many people communicate, buy items, or do their banking online.

### **Future Recommendations**

One recommendation for the future is to conduct a longitudinal study to determine what changes in online instructional tool usage can be noted year to year. It would also be important to find out if rigor continues to be a large concern for teachers related to online instructional tools. This longitudinal study could examine if there are other concerns that teachers or students have noticed after many years of being in a one-to-one iPad environment.

Future studies regarding the mental models of the technology vanguard teachers, who were trained more extensively, would yield important results. Future studies of the mental models of technology non-adapters would also yield important results. Both of these groups are outliers in the spectrum of teachers at this high school. One may assume the findings that would result from these groups, but the research needs to be completed to ensure proper findings are developed.

Another recommendation is a future study regarding mental models of school administrators related to online instructional tools. It would be interesting to determine if the mental model of administrators affects the quality of instruction or quantity of teachers using online instructional tools in their classrooms. The study of school administrators should include district-level administrators and building-level administrators.

As a next step in the research process, which began with this project, the researcher will continue to monitor the evolving integration of online instructional tools

usage by teachers at this high school. The committee's Year 2 expectations for the one-to-one iPad initiative will morph into Year 3 observable expectations. The high school researched already had a 2013-2014 school goal, an extension of the prior year's school goal, which will have a direct effect on the use of online instructional tools in the classrooms. The 2013-2014 school goal challenged every staff member to move one level on the SAMR technology integration model, which was discussed earlier in this paper.

More research is also needed in the area of what precipitates the usage of online instructional tools. More specifically, it is unclear what variables need to be in place or occur that would ensure that teachers would use online instructional tools. Perhaps a survey could be given with a list of various variables that could encourage teachers to use online instructional tools and teachers could check off what would influence teachers to use online instructional tools. Subsequently, the school district could strive to implement those variables, and then the researcher could observe these teachers' classes to determine if the online instructional tools were actually being used.

In the conceptual framework, the researcher discussed that teachers should use contemporary technology to instruct their students because students' use of personal technology is so pervasive in their daily lives. Through interviews, observations, and survey analysis, the researcher has found that teachers are in fact using technology often to instruct their students.

The school that was researched is using an online teacher evaluation system. The Marzano system of observation and evaluation (Marzano & Brown, 2009) allows observers to check off boxes and make comments in a window in online computer

software. By using the online observation system, administrators are modeling the use of online tools to complete tasks that previously were done with pen and paper.

When the researcher was going through the research process, he noticed that professional development could impact the use of online instructional tools in the classrooms. A future study related to professional development, and the impact it has on implementation of online instructional tools, would be a worthwhile study. The concept of comfort with technology came up often in this research, so the researcher would anticipate that the more professional development teachers receive, the more receptive they would be to using online instructional tools in their classrooms.

Future studies are also recommended that focus on viable processes and sources of funding that supports effective technology integration in the classroom. The school that was studied had plenty of access to technology, so the use of online instructional tools was easy to implement. However, changes in political will or changes in budgets could change the access to technology for this high school. If schools limit or do not allow access to technology, then the ability of teachers to instruct using technology is limited.

### **Change Process**

Another implication that should be noted is that the reader should be aware that whenever a new program is implemented, there is often an implementation dip that occurs (Fullan, 2007). An implementation dip often occurs in organizations when they go through a whole scale change. The implementation dip occurs within the first two years, and then the organization can move forward with the change and the organization can prosper. In this study, the program which had an impact on the research was the iPad one-

to-one initiative and this high school certainly experienced a small implementation dip when this program was first started three years ago. The change in how teachers at this high school deliver instruction is important to consider when looking at the data gained from this study. The environment of the one-to-one iPad initiative certainly impacted the interview and survey responses, which impacted the findings of this research.

Teachers have to trust the school administration will make the best decision for the students and staff. From being an administrator in this high school during the change of moving to a one-to-one iPad environment, the researcher noticed during the first year of implementing this change that teachers did not fully believe that the administration had made a good decision. The researcher believes that the reason the teachers did not trust administration was because the decision was made over the summer with little input from the teaching staff, students, or parents. The researcher also noticed that during the past two years, the school administration worked to build trust back with the teaching staff through the use of professional development and the inclusion of the staff and other stakeholders in all decisions moving forward with the one-to-one iPad initiative.

Kotter (1996) identified an eight-stage process, which all organizations go through related to a major change. When thinking about the one-to-one iPad initiative, the researcher can report firsthand how this high school handled each of the stages of the major change process. Kotter stated that the organization should establish a sense of urgency for the stakeholders in the organization so the stakeholders will realize the change needs to occur. This did not happen at this high school because the decision to go to a one-to-one iPad learning environment was made the July before the 2011-2012 school year by a few district-level administrators. The next stage states that the

organization should create a guiding coalition. This school did create a guiding coalition of administrators and teachers during the first few months of this whole school change. Kotter then states that the organization should develop a vision and strategy for the change. This did occur at the researcher's high school; the central administration, school administration, and teaching staff had input in the vision and strategy for implementing the one-to-one iPad initiative. The next step is communicating the change vision to all stakeholders. The researcher feels as though this did happen at this high school, but perhaps not comprehensively enough so that everybody understood the necessity of the change.

Kotter (1996) also said that the organization going through the change process should empower broad-based action, and the researcher feels as though this school community did empower teachers and students to take action with the iPads. Generating short-term wins is also important in a change process, and there were many teachers who created excellent learning experiences for students, which can be seen as short term wins for the iPad initiative. Consolidating gains and producing more change is ongoing in our iPad learning initiative and anchoring these change approaches into the culture of our school is also ongoing because some teachers are still slow at adapting to this change.

In order for an educational change to happen, a "change in practice" must occur. This "change in practice" could come from a use of new or revised resources, new teaching approaches, or the alteration of beliefs (Fullan, 2007). In the school that was researched, all three of these "change in practice" events are occurring. The iPads in the one-to-one initiative can certainly be considered new resources. The one-to-one iPad initiative has also pushed teachers to try new teaching approaches. The study of the

mental models teachers have related to online instructional tools definitely points to an alteration of teacher beliefs.

The change process in Year 1 of the one-to-one iPad initiative was interesting to watch. The researcher found that many early adopters found success with motivating students and colleagues to use the iPads for various learning activities. After about two months, the researcher noticed an implementation dip in which some staff members were fighting the one-to-one initiative.

The change process in Year 2 of the one-to-one iPad initiative was not as eventful as the Year 1 change. Since staff and students had used the iPads for one year, there was more of a comfort level with what was expected of students and staff members. Some teachers were still unsure of how they could effectively use the iPads to enhance or improve instruction. Many of the teachers who became experts at using the iPads were now sharing those best practices with other teachers who were utilizing the iPads less in their classes.

The change process in Year 3 of the one-to-one iPad initiative was one of comfort for many teachers. It is the researcher's opinion that at least three-quarters of the teachers felt comfortable using the iPads to enhance instruction using online instructional tools. These teachers had tried many different online instructional tools and decided which ones enhanced the learning the most, and therefore increased motivation and learning for the students. The researcher noticed through observation that about five percent of the teaching staff still does not use the iPads to enhance instruction. These teachers are being engaged by their colleagues and the administration constantly to assist them to realize

that using online instructional tools could enhance the motivation and learning of their students.

### **Leadership Reflections**

When taking a leadership inventory developed by Glanz (2002), the inventory results showed that the researcher is an adaptive aggressive leader. The researcher feels that the adaptive part of the adaptive aggressive leadership style comes through in his relationships with people at this school (Glanz, 2002). The aggressive part of the researcher's leadership style refers to the strong work ethic of the researcher when dealing with student-related issues. The adaptive and the aggressive sides of the researcher come together to form a leader who makes sure that his staff follows through with initiatives, but also is flexible enough to understand that everybody will go through changes in different ways. The researcher also realizes that all stakeholders need to be supported when going through these changes.

Another strength that the researcher believes he has is the ability to influence students, educators, and parents to view initiatives his way and move them toward school goals. The researcher thinks his ability to relate to people allows him the opportunity to pull people to his side of the situation, and with a few kind words, bring them on board with whatever needs to be done. The ability to influence people is seen an essential to becoming a leader (Wren, 1995).

In the leadership orientations assessment by Bolman and Deal (1988), the assessment results showed that the researcher was found to be a structural and human resources leader. The researcher had a few high scores in the political realm, but most of the high numbers were found in the structural and human resources strands. The human

resource leader emphasizes the importance of people. The structural leader emphasizes rationality, analysis, logic, facts, and data (Bolman & Deal, 1988).

The human resources leader makes sense regarding the researcher's background as a guidance counselor, teacher, and coach, who empathizes with students, parents, and staff members. As a personality trait, the researcher has always liked order and has tried to be very organized. These traits would match well with a structural leader, so the researcher concurs with the Bolman and Deal inventory results (Bolman & Deal, 1988).

The researcher has the opinion that one of his strengths in working in schools is his ability to relate to all of the different stakeholders. The researcher has the opinion that he has always been good at solving people's problems by being empathetic and conversing with them to find a good solution together. That is why the researcher feels that his leadership style would relate to relationships.

Because of his opinion regarding making relationships with stakeholders, the researcher feels that he is a relational leader. The researcher's evidence is that he constantly finds himself developing relationships with staff members, which then allows the researcher to lead those staff members. Related to online instructional tools and the one-to-one iPad initiative at this school, the researcher is trying to share (and have others share) best practices related to the technology uses available to school teachers. The researcher has found that once teachers start sharing best practices, they will continue to share in many capacities. This sharing of best practices will allow teachers to grow and their classroom instruction to improve.

Since the researcher will be sharing best practices related to online instructional tools, he will be acting as a relational leader. A relational leader is described as a good

two-way communicator who listens, provides encouragement, and involves followers in the decision-making process (Hersey, 1985). The constant communication related to change or improvement occurs when you are a relational leader. The relational leader also welcomes feedback from employees and treats this feedback as important dialogue between stakeholders who are trying to move the organization forward.

When the researcher became an assistant principal in this high school, he was asked in one of the interviews if a high school assistant principal should be a building manager or an instructional leader. The researcher answered the interview question saying that an assistant principal should be an instructional leader. Now the question must be asked, “Can the researcher be an instructional leader when he has not taught in a one-to-one iPad environment?” There are some reasons why the researcher believes that he can be an instructional leader in a one-to-one iPad environment. The researcher has experience using online instructional tools when he was a computer applications and Cisco Computer Networking teacher. The researcher has also been trained with iPads and online instructional tools the same way the teachers have been trained, and he has created instructional lessons and activities using iPads and online instructional tools with teachers when they were trained in professional development workshops.

The researcher’s educational leadership style focuses on forming relationships with people and empathizing with their difficult instructional situations as teachers. The researcher believes this style can be effective in working with teachers using online instructional tools, because many times there can be problems with the Internet or an actual online instructional tool or computer application. However, if teachers and

administrators are patient and work through the problems, often the learning can be enhanced.

The researcher believes that one of the main purposes of an educational leader is to increase the leadership capacity of others. Fullan (2007) discusses the concept of developing leaders as a way to sustain change in an organization. In order to do so, the researcher will look to find best practices related to online instructional tools that teachers are using and then challenge these teachers to lead others in the use of these best practices. In particular, the researcher will engage the teachers who are using the “flipped” classroom concept. The researcher will also engage the Vanguard teachers (who have been noticed using many online instructional tools) to develop these teachers as leaders with which other teachers can aspire to when considering using online instructional tools.

This research project was a catalyst for change and enabled the researcher to enhance his leadership skills while trying to improve the teachers he interviewed, observed, and surveyed. One result of this research would be that the teachers researched would reflect on the research process they were involved with and challenge themselves to improve as teachers related to the use of online instructional tools. If these teachers spend more time inspecting their teaching craft, then teachers will improve their teaching outcomes. The researcher has the hope that teachers will continue to utilize online instructional tools to enhance their instruction and allow students to use the most contemporary tools in order to learn the common core academic standards.

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## **Appendix A**

### **Interview Protocol**

The purpose of this study is to examine how high school teachers' mental models of preparation and instruction have changed with the advent of online instructional tools. The study will also determine high school teacher's perceptions of online instructional tools. The study also determine how online instructional tools have changed the instructional methods of high school teachers.

Date:

Time of Interview:

Place:

Interviewee:

Years Teaching-Experience:

Protocol

- I. Introduction (briefly describe the project)
  - a. Thank Participant
  - b. Explain interview process, taping, note taking and confidentiality

Interview Questions

1. What instructional aids do you reference when you plan your lessons for your classes?
2. What strategies do you use to ensure that you infuse technology into your lessons?
3. What has been the most difficult aspect of trying to incorporate online instructional tools into your lessons?
4. What is your perception of online instructional tools?
5. How have online instructional tools changed your instructional methods?

6. Discuss the positive and negative aspects of online instructional tools?
  
7. Share an example of how you used online instructional tools in your classroom.
  
8. How has your instruction changed over time in terms of technological resources? Be specific.
  
9. Discuss the internal struggles that you go through when planning and instructing using online instructional tools.
  
10. Have you ever personally used online instructional tools to learn something? Explain.

## Appendix B

### Survey Questions

1. Please indicate how often you use the iPad or Macbook for the professional activities listed below.
  - a. Create instructional materials for use in class
  - b. Access instructional materials others have created
  - c. Access research on teaching or best practice recommendations from other teachers
  - d. Create and submit lesson plans
  - e. Maintain and access administrative records (for example, grades, attendance, etc.)
  - f. Create digital media presentations for the classrooms
  - g. Post class schedules, assignments, or related resources for student use
  - h. Access assignments students have turned in online
  - i. Publish student work on the web
  - j. Communicate with students (for example, through email)
  - k. Communicate with other teachers in the school
  - l. Communicate with other teachers beyond the school
  - m. Communicate with students' families
  - n. Take and online class
  - o. Other (please specify in next question)
2. Please specify other professional activities for which you use the iPad or Macbook
3. Compared to last school year, how frequently are students using iPads for in-class instruction or activities?
  - a. A lot more than last year
  - b. A little more than last year
  - c. The same as last year
  - d. A little less than last year
  - e. A lot less than last year
4. Compared to last school year, how frequently are students using iPads for activities or assignments outside of school?
  - a. A lot more than last year
  - b. A little more than last year
  - c. The same as last year
  - d. A little less than last year
  - e. A lot less than last year
5. Overall, how often do students in your classes use iPads for in-class instruction or activities this school year?
  - a. Daily
  - b. A few times a week

- c. A few times a month
  - d. Less than once a month
  - e. Rarely or Never
6. Overall, how often do students in your classes use iPads for activities or assignments outside of school this school year?
- a. Daily
  - b. A few times a week
  - c. A few times a month
  - d. Less than once a month
  - e. Rarely or Never
7. Indicate how often your students typically use their iPad for the activities listed below.
- a. Write or edit stories/reports/essays
  - b. Use online worksheets or practice skills
  - c. Communicate using email, instant messaging, Internet
  - d. Work collaboratively with other students
  - e. Participate in online class discussions/bulletin boards
  - f. Take notes
  - g. Turn in homework assignments
  - h. Research a topic using the Internet and other online resources
  - i. Take quizzes or tests
  - j. Design presentations using digital media
  - k. Create graphics/video/webpage or blog/podcast
  - l. Work with spreadsheets/databases
  - m. Play games or surf the web
  - n. Use visualizations or simulations of online content
  - o. Calendar/keep track of due dates and schedule
  - p. Use iPad features (for example, digital cameras, microphone, etc)
  - q. Collaboratively work on a wiki
  - r. Use responsewear website
  - s. Other (please specify in next question)
8. Overall, how well prepared do you feel in using the iPad for classroom instruction?  
(Choose one)
- a. Very well prepared
  - b. Moderately well prepared
  - c. Somewhat well prepared
  - d. Not at all prepared
9. Please describe how you feel you need to be better prepared.
10. Please indicate the extent to which you disagree or agree with each statement below about your own classroom since the iPad implementation.
- a. Students are able to manage their own learning
  - b. I assign simple problems with clear answers to make sure they are accessible to my students

- c. Students tend to be engaged and on task
  - d. Students do most of their work collaboratively in pairs or groups
  - e. The curriculum and class activities are driven by a textbook
  - f. Students do most of their work individually
  - g. I often let students pursue their own interests related to a broad assigned topic area
  - h. I use lectures extensively to make sure students learn they need to know
  - i. Students have access to a variety of up-to-date resources
  - j. The energy level in the classroom can be difficult to manage
  - k. I often assign long-term projects (more than one week to complete)
  - l. Often too many students need my help at the same time
11. The following is a list of statements about changes that may or may not have occurred in your instruction as a result of implementation of the iPad program. Please indicate the extent which you disagree or agree with each of the statements.
- a. Students are more productive in class
  - b. Students can more easily copy work and turn it in as their own
  - c. The information that students find on the Internet enriches their understanding of content
  - d. I feel like I give up too much instructional responsibility to the iPad/computer apps/software – like I’m not really teaching
  - e. I find myself in the role of coach or advisor in the classroom more often than I used to
  - f. iPads distract students from doing the work assigned to them
  - g. I am better able to meet the needs of students with individual needs (for example, low achieving or “gifted students”)
  - h. I am able to engage students in more difficult content
  - i. Students confuse finding information about a topic on the Internet with understanding of that topic
  - j. I am able to make content more relevant to students’ lives
12. What changes, if any in academic achievement/performance have you noticed in your students since the implementation of the iPad program?
- a. The breadth of students’ understanding of the subjects taught
  - b. The depth of students’ understanding of the subjects taught
  - c. Students’ engagement in activities has increased
  - d. The quality of students’ writing
  - e. The quality of the products students create using digital media (for example, digital video, graphics)
  - f. The amount of initiative students take outside class time (for example, doing extra research)
  - g. Students’ research skills
  - h. Students problem-solving skills

- i. The opportunity for students who are traditionally underserved to participate meaningfully in the general curriculum
13. What forms of iPad and Macbook support have been available to you?
- a. Installing apps
  - b. Troubleshooting and maintain iPad or Macbook operations
  - c. Troubleshooting and maintaining network/connectivity
  - d. Integrating iPad activities with curriculum (for example, help in preparing lesson plans)
  - e. Finding new resources related to my curriculum
  - f. Support and solutions for technical questions related to the iPad and/or Macbook
14. When technology breaks down, how long does it typically take to fix the problem?
- a. Less than 1 day
  - b. 1-2 days
  - c. 3-4 days
  - d. 5 days or more
  - e. Not sure
15. Please indicate to what extent, if any, each of the following is a barrier to your use of iPads.
- a. Not all students have/bring iPads
  - b. Lack of digital or online content aligned with curriculum objectives
  - c. Increased preparation time
  - d. iPads are a distraction that encourage unauthorized uses of technology
  - e. Problems with iPad reliability/need for repairs
  - f. Reliability of the wireless network
  - g. iPads are not charged
  - h. Difficulty ensuring safe and ethical use
  - i. Students' lack of adequate technology literacy
  - j. Lack of tech support
  - k. Data loss
  - l. Difficulties with classroom management associated with iPad use
  - m. Lack of student access to Internet at home
  - n. Policies that limit access to the Internet at school
  - o. Theft
  - p. I don't feel prepared to teach with technology
  - q. I don't feel that iPads are an improvement over how I was teaching before
16. Please indicate how effective it was in helping you integrate technology into your instruction.
- a. Participation in an in-district workshop or institute
  - b. Attendance at a college course
  - c. Attendance at an out-of-district workshop or institute
  - d. Participation in a teacher collaborative or network

- e. Attendance at an out-of-district conference
  - f. Working in a an internship or immersion activity
  - g. Working with a mentor, coach, lead teacher or observer
  - h. Use of a teacher resource center
  - i. Participation in a teacher committee or task force
  - j. Participation in a teacher study group
17. Please describe any other professional development activities that you have participated in related to the 1 to 1 iPad learning program in the last year and indicate how effective it was in helping you integrate technology into your instruction.
18. Which of the following topics were covered in your professional development related to the 1 to 1 iPad learning program in the last year and indicate how effective it was in helping you integrate into your instruction?
- a. Helping students meet state and/or district technology standards
  - b. Using the iPad to teach in your primary content area
  - c. Creating lesson plans that incorporate the iPad
  - d. Using iPad applications
  - e. Using the iPad to teach basic skills and facts through drills, tutorials, and learning games
  - f. Using the iPad to promote active learning (for example, using hands-on activities or guided discovery)
  - g. Using the iPad to promote critical thinking
  - h. Using the iPad to make possible collaborative activities with experts or other classes in other places
  - i. Using the iPad to assess student work (for example, portfolios)
  - j. Using the iPad to analyze student assessment results (for example, state/district assessment data)
19. How many years have you been teaching?
- a. 1-4 years
  - b. 5-9 years
  - c. 10-14 years
  - d. 15-20 years
  - e. 20+ years
20. In what subject or subjects is your current teaching assignment? Choose all that apply.
- a. Reading/Language Arts/English
  - b. History/Social Studies
  - c. Mathematics
  - d. Science
  - e. Art/Music
  - f. Foreign Language
  - g. Industrial Arts
  - h. Business
  - i. Health/Physical Education

- j. Special Education
- k. English as a Second Language
- l. Computer or Technology
- m. Speech/Occupational Therapy
- n. Family and Consumer Science
- o. Other, please specify

21. Comments or suggestions for improvement.

**Appendix C**  
**Observation Guide**

<b>School:</b>	
<b>Teacher:</b>	<b>Grade/Subject:</b>
<b>Class Size:</b>	
<b>Observer:</b>	<b>Date:</b>
<b>Time Began:</b>	<b>Time Left:</b>

<b>Brief Description of Classroom Activity/Lesson:</b>          <b>Objective of Lesson:</b>          <b>Student Groupings (single, small, large, etc.) and Interactions:</b>          <b>Technology (hardware and software) and/or Instructional Materials In Use:</b>          <b>How was technology used to achieve objective?</b>          <b>Online instructional tools utilized:</b>          <b>Other Notes:</b>          
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**Appendix D**

**Lesson Plan Template**

**WEEKLY LESSON PLAN  
WEEK BEGINNING:**

**TEACHER NAME:**

**FOR CLASSES MEETING TTh**

	<b>Subject: &lt;Enter Course Name Here&gt;</b>	<b>Block:</b>
Tuesday	Objective(s):  Anticipatory Set:  Procedure / Instructional Strategies:  Evidence of Differentiation (when applicable):  Assessment(s):	

Thursday	<p>Objective(s):</p> <p>Anticipatory Set:</p> <p>Procedure / Instructional Strategies:</p> <p>Evidence of Differentiation (when applicable):</p> <p>Assessment(s):</p>
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## Appendix E

### Year 2 iPad Observable Expectations

- Create a WIKI by the end of the school year (School Goal)
  - Use WIKI to distribute resources, homework hub, organize class, share Internet links with class information
  - Use WIKI to track assignments, create exploratory projects, create presentations, exam review, share notes, peer editing, organize ideas and track participation
  - Use WIKI to create virtual field trips, student created study guides, post difficult problems for class to collaboratively solve, peer review, student portfolios, group authoring, class newspaper and international sharing
- Student slide shows, and slide shows with the use of Internet research
- Reinforce curriculum and augment, modify, and redefine learning activities with the iPad
  - Subject specific
- Use of e-texts where appropriate
  - In lieu of or in addition to tradition texts
- Use apps to enhance student learning
  - On teacher and/or student iPads
- Use iPads for project based learning
  - Create and show projects that enhance instruction of curriculum
- Use online instructional tools to supplement instruction
  - Kahn Academy, itunes U, subject specific online instructional tools, etc.

These are recommendations to be used when applicable in your classes.

## Appendix F

### Interview Codes

Code	Definitions	Category	Examples in interview	Quantity
Projects	Activities teachers give to students using online instructional tools	Uses of online instructional tools	2 or 3 big ideas can be covered in each project using OIT	8
Advantages to OIT	Positive transactions related to OIT	Uses of OIT	Great, getting students ready for learning in the future	4
Disadvantages to OIT	Negative thoughts related to OIT	Uses of OIT	Internet is so vast that students must be critical of info on Internet, some students aren't mature enough for using iPads or OIT, some students have a hard time self-monitoring; sometimes time can be an issue, tech not working (need a plan B)	4
Positive reaction to OIT	Positive reactions to use of OIT	Mental Model	Concepts can be taught more quickly and in depth. The students can visualize what you are talking about by using OIT, use other people's instruction from you tube, "flipped classroom"	5
"Google it"	What has changed in the last 10 years of OIT instruction	Change	If I don't know something my students are asking me I tell them to "google it" and then we discuss what they have found	6
WIKI		Uses of OIT	My whole course is on my wiki so students can access the course at any	8

			time from any internet connected device	
Uses of OIT		Application	Students can see models of labs and exemplars of labs and problems	2
Internal struggle with using OIT	How does a teacher decide if they should use OIT?	Mental Model	I ask myself the question, "Am I doing this because it is better for student learning or am I doing it because they/I want to use technology?"	4
Prepare for lessons	What resources do teachers use to prepare for instruction?	Lesson Preparation	Textbook, internet resources, prior years lesson plans, graphing calculator	4
Mental Model		Mental Model	Was a naysayer, students helped realize that it is not going away, huge learning curve for teachers	6
Internal Struggle with Online Instructional Tools	Teacher decision regarding online instructional tool usage	Mental Model	Am I doing this for better student learning or because we now have iPads?	5
Rigor	Difficulty of assignments to engage learners	Mental Model	Are online instructional tools as rigorous as traditional instructional tools?	9
Change in perception of online instructional tools	Teacher thoughts about online instructional tools	Mental Model	2 years ago I thought online instructional tools were not necessary for quality instruction, now I do	10
Use of online instructional tools now, not before	Application of online instructional tools	Mental Model	I feel more comfortable now using online instructional tools than I did 2 years ago	11

Categories: Lesson Preparation, Mental Model, Change, Uses of OIT (Application)

## Appendix G

### Lesson Plan Examination

Teacher, Year, Number of Lesson      Lesson Objective      Online Instructional Strategies?

Teacher 1, 2008, 1	Review Unit 4	No
Teacher 1, 2008, 2	Extend learning about geometric shapes	No
Teacher 1, 2008, 3	Introduce Theorems	No
Teacher 1, 2009, 1	Analyze angles	No
Teacher 1, 2009, 2	Review Unit 3	No
Teacher 1, 2009, 3	Introduce problem solving methods	No
Teacher 1, 2010, 1	Review Unit 2	No
Teacher 1, 2010, 2	Classify triangles	No
Teacher 1, 2010, 3	Introduce geometric shape qualities	No
Teacher 1, 2011, 1	Graphing shapes	No
Teacher 1, 2011, 2	Review Unit 4	Yes
Teacher 1, 2011, 3	Find interior and exterior angles	No
Teacher 1, 2012, 1	Review Unit 6	Yes
Teacher 1, 2012, 2	Show differences in shapes	No
Teacher 1, 2012, 3	Introduce angle concepts in triangles	Yes

Teacher, Year, Number of Lesson      Lesson Objective      Online Instructional Strategies?

Teacher 2, 2008, 1	Introduce book to be read	No
Teacher 2, 2008, 2	Review concepts introduced in	No

	chapter in their book	
Teacher 2, 2008, 3	Show revising essay techniques	No
Teacher 2, 2009, 1	Show critical reading techniques	No
Teacher 2, 2009, 2	Make corrections on essay	No
Teacher 2, 2009, 3	Introduce new style of poem to be read	No
Teacher 2, 2010, 1	Review chapter 3 in book	No
Teacher 2, 2010, 2	Evaluate authors intent	No
Teacher 2, 2010, 3	Discuss concepts developed in chapter 5 in book	No
Teacher 2, 2011, 1	Role play chapter 2 in book	No
Teacher 2, 2011, 2	Develop timeline of Author's works	Yes
Teacher 2, 2011, 3	Introduce Unit 4	No
Teacher 2, 2012, 1	Review 3 chapters in book students are reading	No
Teacher 2, 2012, 2	Introduce spelling unit related to book	No
Teacher 2, 2012, 3	Obtain and share background knowledge on Author	Yes

Teacher, Year, Number of Lesson      Lesson Objective      Online Instructional Strategies?

Teacher 3, 2008, 1	Discuss the Great Depression	No
Teacher 3, 2008, 2	Highlight important American events of the 1930's	Yes
Teacher 3, 2008, 3	Review events leading up to World War II	No
Teacher 3, 2009, 1	Research the causes for the Vietnam War	Yes
Teacher 3, 2009, 2	Introduce American Industrial	No

	Revolution	
Teacher 3, 2009, 3	Discuss the Roaring 20's	No
Teacher 3, 2010, 1	Discuss the German goals going entering World War II	No
Teacher 3, 2010, 2	Review concepts related to World War II	Yes
Teacher 3, 2010, 3	Discuss the actions of General Eisenhower in World War II	No
Teacher 3, 2011, 1	Introduce the important people in World War II	No
Teacher 3, 2011, 2	Discuss reasons leading up to World War II	Yes
Teacher 3, 2011, 3	Review America's reasons for entering World War II	Yes
Teacher 3, 2012, 1	Discuss the changes in Europe after World War II	No
Teacher 3, 2012, 2	Review surrender circumstances related to World War II	Yes
Teacher 3, 2012, 3	Introduce factors leading to the Korean Conflict	Yes

Teacher, Year, Number of Lesson      Lesson Objective      Online Instructional Strategies?

Teacher 4, 2008, 1	Introduce cell communication	Yes
Teacher 4, 2008, 2	Review plant hormones and responses to the environment	No
Teacher 4, 2008, 3	Discuss animal form and function	No
Teacher 4, 2009, 1	Introduce the nervous, sensory, motor and immune system	Yes
Teacher 4, 2009, 2	Discuss plant structure, growth, and development	No

Teacher 4, 2009, 3	Introduce population genetics and speciation	No
Teacher 4, 2010, 1	Introduce the life cycle	Yes
Teacher 4, 2010, 2	Discuss bacteria and protest display	No
Teacher 4, 2010, 3	Review meiosis	Yes
Teacher 4, 2011, 1	Discuss fungus and plant diversity	No
Teacher 4, 2011, 2	Introduce cell cycle and mitosis	Yes
Teacher 4, 2011, 3	Discuss animal diversity	No
Teacher 4, 2012, 1	Introduce the molecular basis of inheritance	Yes
Teacher 4, 2012, 2	Discuss animal reproduction and development	No
Teacher 4, 2012, 3	Introduce behavioral, population, and community ecology	Yes

Teacher, Year, Number of Lesson      Lesson Objective      Online Instructional Strategies?

Teacher 5, 2008, 1	Introduce and apply basics of ceramic art; tools, clay and safety	No
Teacher 5, 2008, 2	Introduce types of lines, hatching and cross hatching	No
Teacher 5, 2008, 3	Research M.C. Escher's artwork	Yes
Teacher 5, 2009, 1	Review types of shape; geometric and organic	No
Teacher 5, 2009, 2	Introduce ceramic process; construction, firing, and glazing	No
Teacher 5, 2009, 3	Research Gustav Klimt's artwork	Yes

Teacher 5, 2010, 1	Introduce types of lines, contour and stippling	Yes
Teacher 5, 2010, 2	Discuss form vs. shape; related to 2-D and 3-D elements	No
Teacher 5, 2010, 3	Review texture techniques; pen and brush techniques	No
Teacher 5, 2011, 1	Introduce and apply texture techniques	Yes
Teacher 5, 2011, 2	Research Vincent Van Gogh's artwork	Yes
Teacher 5, 2011, 3	Review texture techniques; wash and texture chart	No
Teacher 5, 2012, 1	Introduce and apply cross-contour lines	No
Teacher 5, 2012, 2	Introduce and apply expressive line and landscape drawing	Yes
Teacher 5, 2012, 3	Research and share Rene Magritte's Surrealism art	Yes

Teacher, Year, Number of Lesson      Lesson Objective      Online Instructional Strategies?

Teacher 6, 2008, 1	Introduce what it means to be Hispanic	No
Teacher 6, 2008, 2	Discuss the art of Diego Rivera and Jose Clemente Orozco	No
Teacher 6, 2008, 3	Review the geography of Latin American countries	No
Teacher 6, 2009, 1	Research the music of Latin America	Yes
Teacher 6, 2009, 2	Discuss the news in Latin America, specifically Venezuela, Columbia, Argentina and Chile	No
Teacher 6, 2009, 3	Discuss the history of USA-Cuban relations	No
Teacher 6, 2010, 1	Discuss the Latin American	No

	experience from a women's perspective	
Teacher 6, 2010, 2	Introduce the Literature of Christina Garcia	No
Teacher 6, 2010, 3	Introduce the impact dance has in Latin America	Yes
Teacher 6, 2011, 1	Discuss the news in Latin America, specifically Mexico and Cuba	No
Teacher 6, 2011, 2	Chronological highlights of the history of Latin American countries	Yes
Teacher 6, 2011, 3	Discuss the impact movies have in Latin America	No
Teacher 6, 2012, 1	Introduce the Literature of Julio Cortazar	No
Teacher 6, 2012, 2		No
Teacher 6, 2012, 3	Research famous soccer (futbol) teams in Latin America	Yes

**Appendix H**  
**Observation Table**

Teacher	Tech Used	How tech was used
1	Internet, WIKI	“Teachable moment,” to obtain assignment
2	WIKI	Teacher retrieved slide show from WIKI
3	WIKI, Internet	Told students about extra resources, “Teachable moment”
4	WIKI, response system	To obtain assignment, to measure prior learning
5	WIKI, Internet	Extra resources, “Teachable moment”
6	WIKI	Extra resources, “Teachable moment”