

ABSTRACT

Title of Dissertation: IPADS IN THE SECOND LANGUAGE CLASSROOM: AN EXAMINATION OF IPAD USE BY TEACHERS THROUGH TPACK AND TEACHER PERCEPTION LENSES.

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Research indicates a need for teacher education programs which include embedded computer assisted language learning (CALL) to support teachers' technological pedagogical and content knowledge (TPACK) of how to employ technology in classroom settings. Researchers also indicate a need to better understand the knowledge-base of language teacher education (LTE), including a teacher's possible 40 year career through ever changing technology.

This mixed-method case study examines the use of iPads by four teachers, who represent maximum variation in their teaching and technology experience, in two mostly homogenous schools. The study looks specifically at how teachers'

perceptions of 1) teaching, 2) technology, 3) using technology and 4) their students shape the way they use iPads with English language learners. It also examines what supports facilitate the use of iPads for instructional purposes in second language classrooms.

I focus on the use of iPads in a one-to-one implementation in a technologically embedded context because iPads are a relatively new innovation in classrooms, with the potential of changing instruction. Such changes may contribute to the challenges and benefits of being an effective teacher in the English language teaching (ELT) classroom. Research on the use of iPads in classrooms has been previously limited to mostly suggestions for use and has given little guidance in how this disruption will assist and challenge teachers.

TPACK is used as a powerful construct based in a reconceptualization of the language teacher education (LTE) knowledge-base, indicating influences of context, teachers and their perceptions, identity and agency and activities in the classroom. These factors suggest ways which classroom technology and teacher, student, administrative and contextual influences may mediate the activities of teaching and learning in the classroom.

The data show a correlation between teachers' practices with iPads and their previous experiences using technology in the classroom. Teacher groupings demonstrated differences in teaching based on their experience using technology and teaching. Schools showed differences only in terms of some choices made by the administration. Students' effects on the use of iPads is minimal, except for instances of how student behavior affected the classroom.

IPADS IN THE SECOND LANGAUGE CLASSROOM: AN EXAMINATION OF
IPAD USE BY TEACHERS THROUGH TPACK AND TEACHER PERCEPTION
LENSES.

By

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Dedication

I dedicate this thesis to all of those who helped during my time working on this research. I want to thank the many professors and faculty at the University of Maryland, College Park, who were helpful in my many revisions and discussions on this topic. I want to start with those on my committee who have spent their valuable time assisting in my endeavor: Dr. Martin-Beltran and Dr. MacSwan gave a lot of guidance in terms of language learning; Dr. Peercy was very helpful with information regarding language educators, Dr. Valli provided great insights in terms of methodology and overall guidance of the committee work and finally Dr. Lavine provided considerable assistance in the all the work leading up to the committee review. Without them, I would not have finished.

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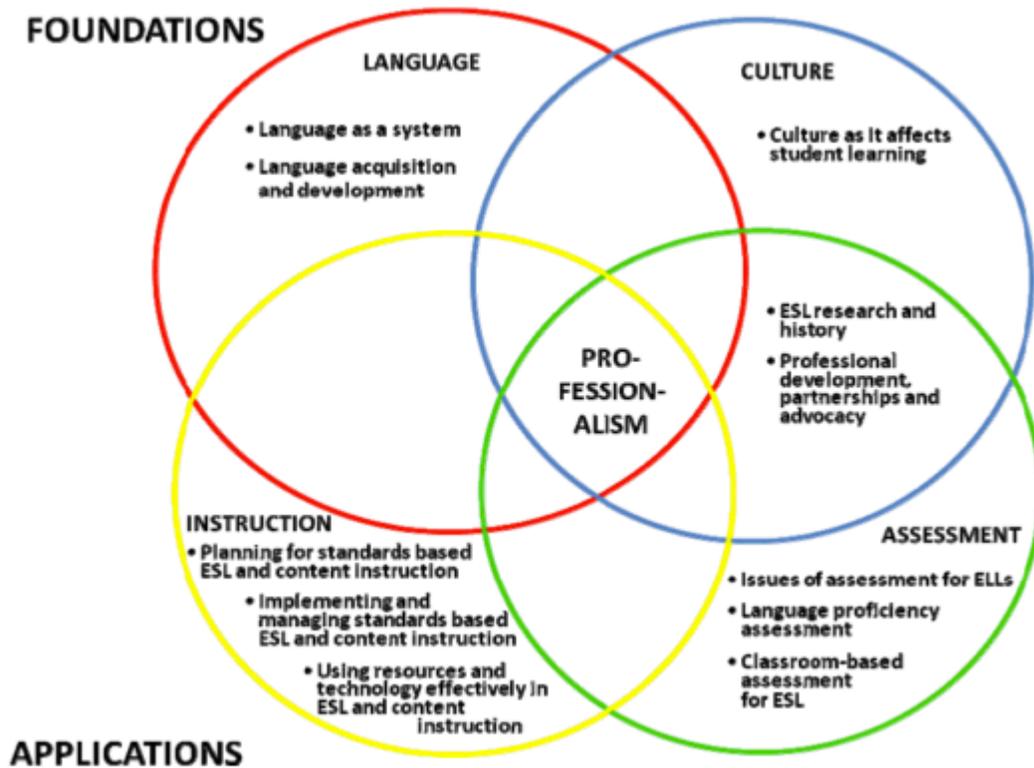
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1. Chapter One: Introduction

Within the field of education, there are many instances of bifurcation between content areas and technology use, instances where there is a separation between research instruction, or standards of a content area like teaching English to speakers of other languages (TESOL), and separate instances of the same for technology. This bifurcation is evident in the many forms of different teaching standards, including subject area and general technology standards. In the instance of general education, there are standards for particular fields of study and there are *technology* standards for either that content area or generic technology. For instance, the international organization which provides guidance for the teaching of English language learners (ELLs) worldwide, Teachers of English for speakers of other languages (TESOL), publishes separate standards for how to teach English to second language users, for teacher educators, for adult education *and* for technology (TESOL, 2012a). TESOL and the Council for the Accreditation of Educator Preparation (CAEP) (formerly NCATE) publish TESOL/CAEP standards for the accreditation of teacher education programs, which mention technological resources in several places. (As of February 2017, CAEP and TESOL were in the process of peer review of standards updates, which seems to address this issue somewhat). The standards are broken up into 5 domains (Language; Culture; Planning, Implementing and Managing Instruction; Assessment; and Professionalism), of which three domains have standards which mention technology, including requirements in the areas of instruction; standards on using resources effectively, 3.c.3 and 3.c.4 (p. 56); assessment, 4.a.1 and 4.a.2 (p. 59); classroom-based assessment 4.c.3 (p. 67); and professional development, partnership and advocacy, 5.b.5 and 5.b.6 (p. 74-5) (see Figure 1-1 below). These standards are only the

beginning of what teacher education needs as it relates to teaching English language learners in regards to technology implementation.

Figure 1-1: TESOL P-12 Teacher Education Program Standards (TESOL, 2010, p. 20).



Subsequently, there are further limitations of the TESOL/CAEP standards with regard to teacher preparation. Hubbard (2008) suggested there should be standards regarding preparing teachers to learn about the changes in technology. Also the TESOL/CAEP standards do not indicate changes in activities where technological mediation of language would require of language learning, as indicated by Warschauer (2004). Even with the elements of technology integration mentioned above, TESOL has decided on the need to publish separate standards for Technology on “how English

language teachers, teacher educators, and administrators can and should use technology in and out of the classroom” (TESOL, 2012b, p. 1).

Other examples of this bifurcation of standards include those from the Maryland State Department of Education (MSDE), which include the Common Core standards for English language learning (MSDE, 2011a, 2011b, 2011c, 2011d), but also has technology standards for teachers (MSDE, 2002) and for student literacy (MSDE, 2007). This bifurcation is at the core of this study, which proposes to combine two frameworks – one relating to second language teacher education and the other relating to technology teacher education. The first is focused entirely on content area, without any mention of the need of technology integration, while the former is focused on technology, but does not specify a content area. This continues the notion that technology integration is simply an afterthought, or that its use is not influenced by the content area into which it is integrated. Understanding that teachers need to learn how to use technology in education, and that the understanding of how to use technology is specific to their content area, is what the combination of these domains is all about.

Several scholars (Butler-Pascoe, 1997; Hubbard, 2008; Kessler, 2006) have pointed to the lack of training that teachers receive in their teacher education programs to prepare them to work with technology. Kessler (2006) found that a majority of teachers felt that their preparation in the use of computer assisted language learning (CALL) was insufficient. Hubbard (2008) has pointed that teacher educators need to move beyond teaching how to use the most current technology trend in the classrooms. He states that technology will likely change before the teachers have been in practice for five years – but that they need to be prepared to understand and learn about technological changes for

forty or more years of their career. As recently as 2015, Arnold and Ducate (Arnold, 2013; Arnold & Ducate, 2015) indicate concerns with teacher development in CALL, with Arnold (2013) also examining the role of textbooks. While giving a positive review, they indicate that there is a role to be played in modifying teacher education texts to support teacher-learners cognition of technology use. Therefore, teachers need to be prepared to adapt to the new landscape of technological innovation in educational practices as it emerges.

While understanding the needs of teachers to learn about technology is important, it is also essential to clarify what exactly “technology” is. Several scholars (Bax, 2003; Kern, 2006; Zhao, 2003) have been concerned about the question of effectiveness of technologically enhanced instruction. The challenge comes from trying to evaluate the effectiveness of “technology” in the classroom. Zhao lists two problems, one is that “technology is... ill defined” (p. 8), and that it has a myriad of elements. He says, “[i]t is... misleading to think the effect of videotapes are the same as those of online chatrooms [therefore the effectiveness of technology]... lies in its uses” (p. 8). A final problem he sees regarding the evaluation of instructional technology is that its “effectiveness... is mediated by many other variables – the learner, the task, the instructional setting, and... the assessment tool” (p. 8). While the effectiveness debate rages, the problem still exists that students need to have access to technology to be productive members of society (Oxford & Jung, 2007).

Oxford and Jung (2007) discussed in great depth the needs of second language learners. They have stated that many of these language learners come from less developed countries, where they may never have seen a computer before, let alone had a

chance to use it themselves. The experiences of these students, therefore, is greatly different from what are sometimes called digital natives (Prensky, 2001), or the millennials, who have been shown to be very active in their use of technology (Jones & Fox, 2009; Kelly, 2007; Lenhart, Simon, & Graziano, 2001). These differences put up barriers for students who do not have the same experiences with technology and will make it more difficult for them to advance in their careers (Oxford & Jung, 2007).

In order to address the needs of these students, Kelly (2007) proposes that a different kind of digital divide needs to be bridged. He claims that the first digital divide – access to technology – has changed from one of access to some kind of technology, to access to equal kinds of technology. He states that Asian and Caucasian children even of low socioeconomic status usually have access to better technology and connection than those children from Hispanic and African American households with the same status. Beyond the standard definition of the access he describes two other forms of digital divide, which fall along the same ethnic division: access to technologically-enhanced teaching methods which are both “achievement-enhancing” and “culturally-sensitive”. So, while a part of the challenge is access to the right kinds of technology, at least two-thirds of the digital divide that Kelly describes is a result of the quality of teaching received by the student.

Given the challenges associated with teacher education programs and technology integration, this research explores the development of technological knowledge of second language (L2) teachers. While there has been much research on the need for effective technological training, there has not been a lot of research on what teachers need to know in order to be technologically savvy practitioners throughout a 40-year career. This study

will use two frameworks, that of second language teacher education (SLTE) research - developed by Freeman and Johnson (1998) - and the technological pedagogical and content knowledge (TPACK) framework - developed by Mishra and Koehler (2006).

While these frameworks help with understanding teacher knowledge and the knowledge-base, they cannot be studied in a vacuum. The context of the present study involves schools which use iPads in all of their classrooms. iPads have become very popular since their inception in 2011, with more than 1000 schools across the US incorporating one-to-one iPad to student implementations (Mclester, 2012). While iPads are abundant in classes, there has been little research on their use, especially in second language classrooms. The iPad implementation in two middle schools in Rollings County (all references in the study are pseudonyms) makes a useful situation to study technological innovation and the TPACK needed to implement it.

I will now address the purpose of this study and provide the research questions. I will discuss the literature base and how it leads to the conceptual framework. I will briefly mention the methodology for the study. Next, I will discuss what I consider the significance of the study. Then I will preview some of the data gathered from the study, and I will describe the study's major findings. Finally, I will end with some key terms to help with consistent understanding through this study.

In Chapter Two, I will review the relevant literature relating to the framework I am using for my study. In Chapter Three, I will discuss the methodology for the study. In Chapter Four, I will review the results of the study, and finally, in Chapter Five, I will analyze and discuss the implications of the study. In Chapter Six I will specify the conclusions of the study.

Purpose of Study

The purpose of this study is to identify and annotate the ways in which different ESOL (English for speakers of other languages) teachers use iPads to support language learning in their classrooms. The study examines ESOL teachers in an initiative of one-to-one implementation of iPads in the classroom. The implementation allows teachers to show how they use iPads with their students for the purposes of instruction. Also, it allows for some comparison between the different teachers as to how they are similar or different based on variation in age and experience.

Through this study, insights might be gained through the influences of teachers' perceptions of technology and technology use; their perceptions of teaching in general; and their perceptions of students. Other insights could involve how all of these factors might influence educators' agency in regards to their use of iPads in the ESOL classroom. Finally, as iPads are relatively new, and most teachers have not had many opportunities to teach with them prior to this study, it provides an opportunity to see what kinds of supports are needed for teachers to be able to use iPads in the ESOL classroom.

This study was conducted in the context of a public school system in ESOL classrooms of middle school students, where the school system had implemented a one-to-one deployment of iPads for students. While the study of iPad use will help me focus on the particular needs of teachers using iPads in the classroom, and how classroom interactions and teacher knowledge assist in their successful use, I also hope to gain some insights as to how teachers may adapt to new innovations in classroom practice, and how they can learn how to use such new ideas.

With these concepts in mind, this research explores the following questions:

1. How do teachers of language learners use iPads in their classrooms?
 - a. How do teachers' perceptions of teaching, technology, using technology and their students shape the way they use iPads with English language learners?
 - b. What supports facilitate the use of iPads for instructional purposes in second language classrooms?

Conceptual Framework

This research works from two conceptual frameworks in the hopes of combining two areas of study: the knowledge-base for SLTE and the knowledge-base for TPACK. Through this combination of frameworks the research hopes to gain insights into how the two knowledge-bases can work with and support each other. The combined conceptual framework contains elements of each of the supporting frameworks. For instance, the TPACK framework (Koehler & Mishra, 2005) brings four additional domains of technological knowledge and the framework developed by Freeman and Johnson (1998) for TESOL brings three domains and three processes.

Within these frameworks, there has been much work over the past several years regarding analysis of content. For the TPACK framework, the analysis will be based on work by Margaret Niess and her TPACK growth evaluation (Niess, 2011; Niess, van Zee, & Gillow-Wiles, 2010) (see Appendix B). Further analysis of the data will be conducted through an examination of activity of teaching and learning (Freeman & Johnson, 1998, 2004), teacher agency (Burns & Richards, 2009; Johnson, 2015, 2016), intentionality (Kubanyiova & Feryok, 2015) and identity (Arnold, 2013; Arnold & Ducate, 2015; Attia, 2014; Burns & Richards, 2009; Johnson, 2016; Kubanyiova & Crookes, 2016); an

examination of *obuchenie* (Johnson, 2015; Kubanyiova & Feryok, 2015) in the context of the TESOL classroom with technology.

Methodology

This research is a multiple case analysis of teachers in two schools in Rollings Public Schools (all names are pseudonyms). I focused on two of four middle schools which had one-to one implementations of iPads with a significant ESOL population and at least two ESOL teachers. All of the teachers taught language of some form, but all also taught a content area other than language. Data collection consisted of the following: two interviews with the principals (one at the beginning and one at the end); a pre and post interview with the teachers; and, in so far as was possible, two observations of each class taught by each teacher, for a total of eight observations, each with a post-observation interview.

Initially, analysis of the data consisted of creating themes related to the conceptual framework relevant to the research questions. Themes were collected initially in broad categories such as “personal experience and background”, “school”, “teaching activities” and “technological knowledge” (discussed further in Chapter Two). As these themes were further refined, they assisted in the qualitative analysis. After the initial analysis of data, activities recorded were evaluated based on their student-centeredness, which Niess et al., (2010) suggested would be one measure of greater levels of TPACK. The levels of matrix of student-centeredness is discussed further in Chapter Two.

Significance of the Study

The purpose of this study is to understand how teachers use iPads in language learning classrooms: identify how teachers' perceptions of teaching, technology, technology use, and students affect their use; and indicate what supports are needed for iPad use to be successful. More specifically, it aims to add to the knowledge-base regarding the use of technology in the second language teaching classroom with reference to the TPACK framework developed by Mishra and Koehler (2006) and the knowledge-base of second language teacher education developed by Freeman and Johnson (1998). There is potential to examine an alternative framework through a combination of the aforementioned frameworks and the research.

Definition of Key Terms

Applications – are programs/software which are used by computers to either produce products, or create an activity for a user to participate in. Applications that are a part of the research are listed as part of Appendix A, with a description and brief graphic, and are categorized based on their purpose (Means, 1994; Murray & Olcese, 2011). These applications are marked with *italics* throughout.

Computer assisted language learning (CALL) – is the knowledge-base regarding the use of computers or other kinds of technology within the field of language learning and instruction and the study of this knowledge-base. CALL is equivalent to the TPACK for teachers who teach in the field of second language education.

Content knowledge – is the knowledge that is associated with a teacher’s content area, e.g., a science teacher would know scientific concepts; a language teacher would know about a particular language.

English language learners (ELLs) – are students who are (generally) from another country and speak another language at home, or have another language which is their primary language (L1). There are other terms which are comparable:

English for speakers of other languages (ESOL) students, limited English proficient (LEP) students, English as a second language (ESL) students.

English for speakers of other languages (ESOL) – is a term used to refer to the instruction of ELLs to provide them with assistance in learning English. Also referred to as English as a second language (ESL).

Hardware – includes anything physical that a user can touch which may or may not use applications to support its use (for example: computers, projectors, interactive white boards and iPads). All hardware, except iPads, that are a part of the research are listed as a part of Appendix A, with a description and a brief graphic. This hardware is marked with *italics* throughout.

Hybrid class – is a class that is composed partly of an online component and partly of a face-to-face component. Hybrid (or blended) classes have many definitions (Allen & Seaman, 2008; Grgurovic, 2011; Scida & Saury, 2006). A hybrid class has been defined either as a percentage of class conducted online (Allen & Seaman, 2008) or through the benefits hybridization provides a course (Grgurovic, 2011; Scida & Saury, 2006). For this study, it is sufficient to say that both the online part and the face-to-face part of the class are significant to the goals of the class.

Knowledge-base – is the concept advanced by Shulman (1986) initially which presupposes that teaching is a professional field which should have a general basis of knowledge that is consistent both across all disciplines and within disciplines as well. The knowledge-base would inform teacher educators on the specific needs of teacher-candidates prior to entering the field.

Mediation – is the notion that human activity is mediated, or modified, through the use of tools and signs. Tools and signs can include not only language, but technology as well (Warschauer, 2005).

Pedagogical content knowledge (PCK) – as originally described by Shulman (1986), pedagogical content knowledge is the body of knowledge generally considered to be relevant to teaching, because it is the confluence of pedagogical knowledge and content knowledge. Therefore, it is teaching knowledge applied to a specific content area.

Pedagogical knowledge – refers to the knowledge-base of teacher education as it relates to all fields of teaching. That is to say, general teaching knowledge which can apply in any teaching field.

Praxis – is the dialectic between classroom practice and research, so that both can be informed by each other – a process where SLA (second language acquisition) researchers are deciding the important contexts for learning while considering the contexts in which the teacher and the student will find their language learning activities and how teachers and teaching influence these decisions (Lantolf, 2008).

Project-based learning – is a teaching style which enables students to explore and develop their ideas through the creation of projects, usually as a part of a group, thus enabling them to evaluate their knowledge in a real-world situation.

Student-centered learning – is teaching which is focused on the learner and their participation in active learning, rather than on the teacher and passive learning.

Students – for this study, any mention of students that is unmarked will refer either to pk-12 students, or other level *language* students, not students in courses progressing towards becoming a *language teacher*.

Teachers – for this study, teacher refers to any *language teacher* who is in practice either during the study in question or hypothetically, at any level of instruction, except for teaching teacher candidates (below).

Teacher candidates – (may also be teacher-learner or teacher as learner) for this review, refer to any “students”, whether currently, or at some point of reference in a study, or hypothetically, who are studying to become *language teachers*.

Teacher educators – for this study, teacher educators are people in higher education responsible for the instruction of “teacher candidates” (above) to prepare them for working with language learners.

Technologically enhanced language teacher education (TELTE) – is the notion of second language teacher education’s knowledge-base which has been modified in a way similar to TPACK’s addition to PCK. TELTE is the combination of the frameworks which are used to guide the study.

Technological content knowledge – is the notion created by Koehler and Mishra (2005) which combines technological knowledge with content knowledge, which shows

how technology can be used within a particular content area without the influence of pedagogy.

Technological pedagogical and content knowledge (TPACK) – is a modification of Shulman’s PCK as defined by Koehler and Mishra (2005) to include technological knowledge. Essentially it assumes that teachers’ knowledge of teaching a specific content area using technology will be different depending on the content area and the pedagogy used to support the content area. TPACK and TPCK are interchangeable acronyms for technological pedagogical content knowledge. TPCK -- the first one -- created by Koehler & Mishra (2005), was considered to be hard to pronounce, so at a conference of the International Society of Technology in Education, they decided to change the acronym to TPACK (Thompson & Mishra, 2007)

Technological pedagogical knowledge – is the notion defined by Koehler and Mishra (2005) as the form of technological knowledge which is informed by only pedagogical knowledge, allowing generic pedagogical knowledge and technological practices to be combined without content.

Technological knowledge – is the notion defined by Koehler and Mishra (2005), which represents all the general knowledge of the uses of technology, with or without connection to any field of endeavor.

Technology – in this study, technology is used as a broad term, including anything related to the use of computers, software, other kinds of hardware, digital media, electronic communication or the like which is innovative.

Summary

In this chapter I have given a brief outline of some of the issues associated with technology and second language learning. I have discussed the bifurcation of the domains of teacher education (and other aspects of teaching) which regards technology as one area, and fields of study as another, with only a moderate mixing of the two. I have discussed how technology is an issue for teachers regardless of whether the students they teach have extensive knowledge about technology or limited experience. I have explored the issues associated with defining technology and how research has not been effective in discussing its effect on learning. I have also presented the frameworks for my study and the context. I will further discuss the frameworks, the interest in the use of the iPad in the classroom and other research related to technology use in teacher education in Chapter Two.

I have also presented a brief overview of the case methodology research methods I employed. More on the rationale for this choice and the specifics of the methodology will be presented in Chapter Three. In addition, I have provided definitions of key terms in this study. Finally, I have also briefly discussed the potential significance of this research to bring together the two teacher education frameworks: TPACK and the SLTE knowledge-base.

2. Chapter Two: Literature Review

The literature review is broken up into four major segments based on research which is related to the research questions (see Chapter One). First we need to understand how researchers and teacher educators incorporate knowledge needed by teachers to use technology in the language classrooms into their knowledge-base. Also it is important to understand the area of research related to using technology in the classroom, and more specifically, research related to teacher education in the computer assisted language learning field (CALL). The third area of focus is that of expert teachers, which will allow me to discuss elements of teaching which are indicators of expertise. The final area of focus is more contextually based, and it looks at research which is related to using iPads in the language learning classroom.

Initially I will discuss the knowledge frameworks which are the basis for current research in the language teacher education (LTE) and technology integration. These frameworks are Freeman and Johnson's (1998) reconceptualized knowledge-base for language teacher education (LTE) and Mishra and Koehler's (2005, 2006) technological pedagogical and content knowledge (TPACK) framework.

The second section of the literature review looks at this research-base, computer assisted language learning (CALL) research in general and more specifically as it relates to teacher education. There will also be an examination of how TPACK studies relate to CALL, an examination of teacher beliefs and a look at sociocultural theory as it relates to CALL.

The third section will examine the basis for expertise research in education and how it is compared to other fields of expertise in other domains. Key to this relatively

new area of research is that experienced teachers are not necessarily expert teachers and that expert teachers have qualities which can be identified (Tsui, 2009b).

Finally, in the fourth section, I will examine research regarding the use of iPads in the classroom. Research on iPads and language learning has been somewhat limited. However, I review all the available information regarding iPad use in language learning situations and will also look at research on iPad use from other fields that may be relevant to this study.

Guiding frameworks

The history of second language teacher education (SLTE) has been fairly brief (Johnson, 2016). It started with training courses in the 1960s and only began as a field of research in the late 1980s. Up to the late 1980s the field of teacher research was only informed through the ideas of “teachers as doers” rather than “teachers as thinkers” (p. 122). Up until that point it was defined primarily through how language was acquired rather than the sociocultural context in which language learning occurs (Johnson, 2009). This focus was all changed by the pioneering work of Firth and Wagner (1997) which preceded its reconceptualization by Freeman and Johnson (1998).

TESOL's knowledge-base as it has been reconceptualized by Freeman and Johnson (1998) includes three domains: the context of school and schooling, the activity of teaching and learning, and the teacher as learner. In 1998, technological education and computer assisted language learning (CALL) were only emerging as fields of study and were not incorporated into their framework. Since that time, Mishra and Koehler (2006) have developed a framework for understanding how aspects of technological knowledge interacts with the pedagogical and content knowledge to form a different construct,

depending on the content being instructed. The question then is: How would researchers and teacher educators incorporate knowledge needed by teachers to use technology in second language classrooms into their knowledge-base framework?

In order to understand this question in some depth, this literature review will examine both 1) integrating technological knowledge into Freeman and Johnson's framework and how this integration presupposes that the resulting TPACK for language learning would be different from other content areas and 2) incorporating technological knowledge and the content specific TPACK into the knowledge-base developed by Freeman and Johnson. Consequently, I will examine the development of both TPACK and Freeman and Johnson's knowledge-base as a development of Shulman's (1986) pedagogical content knowledge (PCK). I will look at some critiques of the frameworks, especially of Freeman and Johnson's. Finally I will present a framework which combines the two.

Understanding TPACK. In order to examine this idea in more detail, I will start by examining Shulman's (1986) as the basis for Koehler and Mishra's (2005) formulation of TPACK. I will discuss the rationale for the development of TPACK in terms of how content and pedagogy effect the incorporation of technological knowledge into instruction and give a brief example of how second language teacher education TPACK would look.

Shulman's (1986) pedagogical content knowledge. It is hard to examine an educational knowledge-base without discussing how Lee Shulman (1986) has influenced further research in the area. Shulman's theoretical discussion of teaching standards included how they have influenced the dichotomy between content knowledge (CK) and

pedagogical knowledge (PK), and how this dichotomy has been in flux over the previous century. Shulman starts his discussion by recalling teacher tests in the late 1800s which heavily emphasized content knowledge. He contrasts that emphasis sharply with standards in the 1980s-1990s which seem to be almost entirely devoid of an emphasis on content and focused primarily on pedagogy.

Shulman's (1986) analysis points to the need for a middle ground, which he coined as pedagogical content knowledge (PCK). Shulman postulates three elements of PCK: propositional knowledge, case knowledge and strategic knowledge. Propositional knowledge is the understanding of propositions or theories. Case knowledge is an understanding of a certain context specific situation which applies the proposition and demonstrates how it is effective. Finally, strategic knowledge is the teacher's knowledge of when to apply the case knowledge (and by extension the proposition) to a specific classroom situation. For example, the acquisition of the grammatical morphemes of irregular verbs are acquired before regular verbs (Kwon, 2005) is predicted in English as a first language (L1). This theory would be a proposition. Case knowledge would show a situation that with second language (L2) acquisition, the L1 may influence the order of acquisition such that regular verbs might be acquired prior to irregular ones (Kwon, 2005). Finally, strategic knowledge would apply this situation to a specific situation in the class, indicating the need to teach or review the regular past to allow students the metacognitive strategies needed to identify the regular and irregular past, learn when to use each, and how the L2 may affect the choices of which to teach first.

Shulman (1986) also suggests that learning propositional knowledge is not sufficient to understanding how to teach a particular content area. He suggests that

propositions are not memorable, and do not easily transfer to the classroom: “*How* does a teacher apply, for example, ‘check for understanding’?” (p. 11, emphasis retained).

Therefore, his study of instructional cases goes more to the point of PCK. He suggests practitioners study those examples of a particular field of knowledge that are exemplars of the best practices in teaching. Cases show a particularly effective way of teaching an item, or perhaps demonstrate how a particular teaching strategy may or may not work. Through the use of these kinds of cases, teachers can strategically develop methods of teaching to employ their propositional knowledge and develop the wisdom to cover new situations which arise in their practice.

In second language teacher education (SLTE), as in other disciplines, the knowledge of instruction is more than the knowledge of the content. In this instance SLTE is more than educating teacher candidates about second language acquisition, or even the structures of language (linguistics). It is the knowledge of, as Shulman (1986) suggests, propositions of teacher practice which can be learned as lists and descriptions. Propositions need to be demonstrated through the use of case lessons about language learning classrooms. When propositions are combined with the strategic case knowledge of when to use the practices therein, the teacher can work to better help students learn a second language.

The ideas of pedagogical content knowledge, the combination of propositions and case and strategic knowledge are notions to keep in mind during this discussion of what is known about SLTE and the development of TPACK.

Elements of the technological pedagogical and content knowledge framework.

When Koehler and Mishra (2005, 2006) introduced the concept of technological

pedagogical and content knowledge (TPACK), they were concerned with the differences in how TPACK might be expressed when teaching different content areas. They constructed an abstract concept of Technological Knowledge and linked it to the idea of Shulman's (1986) pedagogical content knowledge. They then created a framework to address the abilities that teacher candidates need to develop in order to use technological knowledge to mediate classroom activities when using technology, as well as continue to develop this knowledge as technology changes, and their practice necessarily changes.

A kind of praxis develops wherein innovations in technology and technological knowledge cause adjustment to practice. These changes both influence and are influenced by research based on the TPACK framework which, in turn, may suggest further modifications in practice to support effective teaching. It was clear to Koehler and Mishra (2005) that there was more to teaching using technology than just a sum of technological knowledge and pedagogical content knowledge. For Koehler and Mishra, teachers need to have some basic understanding of how to use technology in the classroom, so that it is seamlessly integrated into instruction and seems a fluid part of learning. As they say:

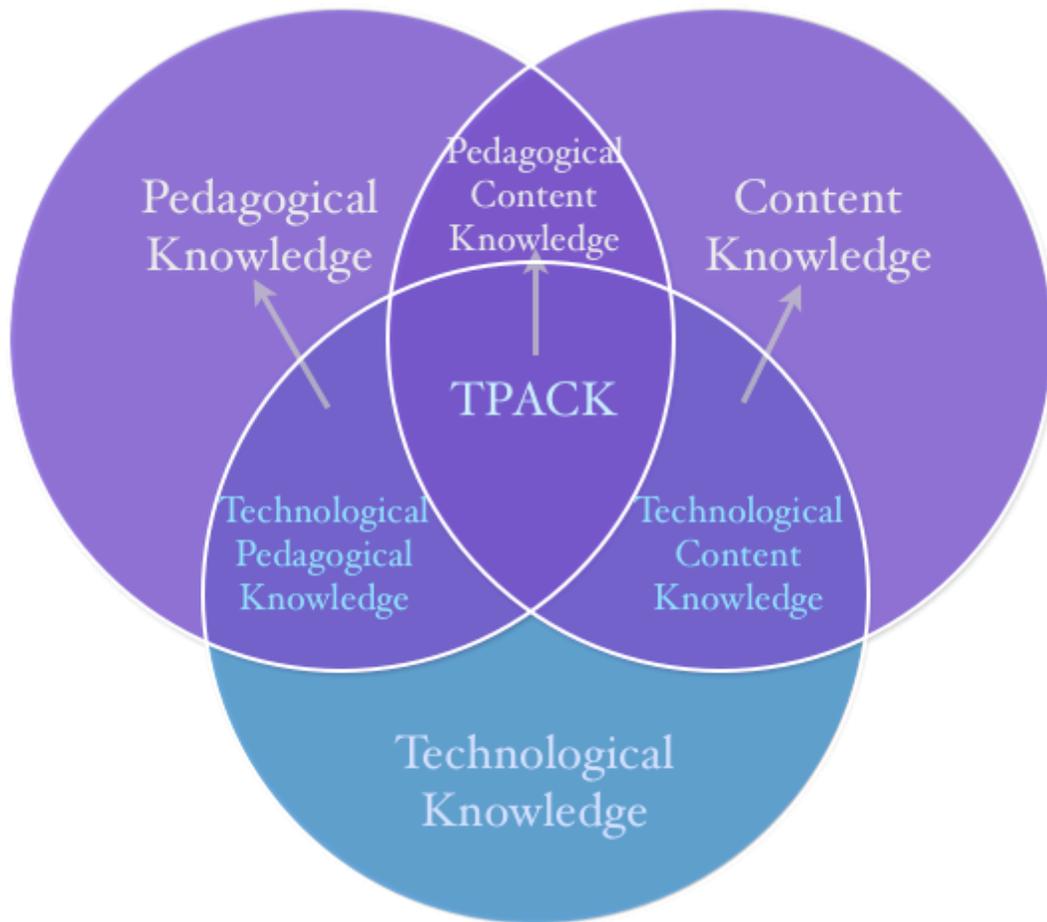
[g]ood teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts and requires developing a sensitivity to the dynamic, transactional relationship between all three components suggested by the TPCK framework. (Koehler & Mishra, 2005, p. 134)

TPACK is based on Shulman's (1986) ideas about PCK, but the thoughtful addition of technological knowledge dramatically changes the whole framework.

Technological knowledge. Technological knowledge is a teacher's knowledge of technology as a tool (software or hardware) – considering that technology a fairly 'recent' innovation. Technological knowledge not only includes a teacher's knowledge of how to use the "technology" in a personal setting such as using e-mail for personal or professional communication, but, overlapping with pedagogical knowledge, content knowledge and PCK. Therefore, the TPACK framework includes technological aspects of knowledge related to teaching and the content area. While technological knowledge is never actually devoid of any particular context, it may be very separate from a particular content or pedagogical knowledge. For example, a teacher may understand how to use a computer for e-mail, but may not understand how to teach students to use the e-mail in class. Technological knowledge is quite simply the knowledge of all aspects of any kind of technology, regardless of whether it is used for education or not.

When Cox and Graham (2009) talk about technological knowledge in terms of their elaboration of the TPACK framework, they contend that anything within the realm of technological knowledge will eventually move into a more general form of knowledge (see arrows in Figure 2-1). For example, Kern (2006) has suggested that technologies like chalkboards, pencils and other such items at one time could have been considered technological innovations in teaching. However, as these "technologies" became more accepted, they were no longer considered technological advances. Cox and Graham (2009) use this idea of changing technology to explain the boundaries between the instruction of emerging technologies with instruction in common practice.

Figure 2-1 Technological Pedagogical and Content Knowledge (based on Cox & Graham, 2009).



This notion of TPACK and other forms of technological knowledge being continuously updated goes against the idea of Bax's (2003) normalization. Bax states that the next version of CALL – integrated CALL – will occur when technology instruction for language learning will become normalized within SLTE. “Normalized” refers to Bax’s notion that, as we understand the use of computers more clearly, and this knowledge becomes more mainstream (or normalized), there will no longer be a need to either teach CALL, or even study CALL as it pertains to language teaching and learning. While Bax specifically talks about “computers”, computers and innovation have often been considered a part of the CALL framework. It is unclear, therefore, if he believes

that it is only computers which will become normalized, or if he feels that other innovations within the CALL field will also become normalized. Still, he presupposes that CALL will be embedded within the teacher education program as a part of regular practice, just like using chalkboards or pens became normalized in the past.

Hubbard (2008) suggests that this supposition presupposes that technology and other forms of digital media are stagnant in the ways that using pens or chalkboards are stagnant. Once researchers learn enough about technology, it will not change in any significant way that will require further study of CALL or TPACK. However, since Bax published his article, social media has become a new and emerging topic, for which a recent search of educational databases narrowed for '2015' 'social media and 'language education' produced 9,839 results. The recent proliferation of social media (and now mobile technology) and educational research suggests that the normalization that Bax predicted is not going to happen any time soon, even if the discussion is solely about "computers" and their uses. Even Bax (2011) has seemed to step back from the notion that all computer technology will become normalized.

Technological knowledge overlapping Shulman's (1986) PCK. Within the three-circle Venn diagram (Figure 2-1), where technological, pedagogical and content knowledge meet, are several overlapping areas. One of these areas is the aforementioned pedagogical content knowledge described by Shulman (1986). The other three areas are where technological knowledge merges with content, pedagogical and pedagogical content knowledge. These overlaps create three distinct areas of technological knowledge, those being technological pedagogical knowledge, technological content knowledge, and technological pedagogical and content knowledge (TPACK)

respectively. Each of these areas has a 'grey area' of boundary, which the elaborated model of Cox and Graham (2009) attempts to explain. These boundaries are not hard and fast. Still, distinctions can be made between each area.

Generally speaking, as previously noted, technological knowledge is the knowledge of how to use a particular "emerging technology" (Cox & Graham, 2009, p. 63), for example, using a blog to write a personal journal that would be completely neutral to content and pedagogy. The separation of technological knowledge from the other two in this way shows that people can use a computer without understanding how to use a computer for instruction. As an example of this separation, Kessler (2010) reports on technologically competent teacher candidates who struggle to use technology to teach effectively.

Technological content knowledge would, therefore, be knowledge of how to represent content within a particular technological framework. Technological content knowledge would be independent of pedagogy, because *how* the content would be presented to students pedagogically would not be considered. As an example, teachers can know about how to write a blog professionally without having the concept of how to use blogs in a teaching setting. When you start dealing with general pedagogical activities or strategies and how they relate to technology, then you are talking about technological pedagogical knowledge. An example of technological pedagogical knowledge would be using *PowerPoint* to outline a topic, without specifying the topic in particular. These activities are content neutral, in that they can be used with many different forms of content and their use is unrelated to the content being taught.

The final overlap in the Venn Diagram, is where all four knowledge domains meet, or TPACK. This domain has the teacher using activities specific to the content area within methodologies using particular technology to support the activities (Cox & Graham, 2009). For example, using a writing blog (one with protections for students) in a language classroom, and allowing students to comment on each other's blog, would be an example of a technological activity focused on the content of language learning; here teachers choose safe sites to protect the students from outside observers and content distraction, motivate interaction with a focus on reading on writing skills, and provide instruction on how best to use them in the class. Through the use of these activities, students would not only gain the knowledge of the content of language use, but also practice using a tool that helps to develop this knowledge (e.g., blogs), which is a form of TPACK.

Second language teacher education TPACK. According to van Olphen (2006), many different components of content knowledge exist within the second language learning community. In her review, she discovered that language proficiency came up often in many different models of expertise. She also suggested other elements of linguistic content knowledge are related to the use, as well as an understanding of culture. However, simply knowing about the content would not be sufficient to be a good teacher of language. For example, if you consider native speakers of a language, one might think that they would be experts in teaching, but even after adding a “21-credit add-on ELL [English language learner] endorsement,” a native English speaker, Sean, was unable to effectively explain to ELLs how to conjugate verbs in the present tense (Reeves, 2009, p. 116).

Native speaker knowledge of language does not prepare teachers to teach second language learners – it does not even prepare them to teach. Only through an understanding of case knowledge and strategic knowledge, which are main components of Shulman's (1986) pedagogical content knowledge, would the teacher develop the ability to diagnose the linguistic needs of the student and incorporate an appropriate activity to provide a probable learning result. Understanding teacher knowledge is further complicated by the context of the learning situation.

According to Freeman and Johnson (1998), language learning is a social process because it is how we communicate with one another. Further extending this notion of the necessary skills for second language teacher education, pedagogical content knowledge would certainly include the other areas that Freeman and Johnson suggested in their reconceptualization of the knowledge-base: the context of place in school and process in schooling, the activity of teaching and learning and the teacher as learner. I will discuss these points in more depth in the section on the second language teacher education knowledge-base.

When you apply technological knowledge to the content and pedagogy of language instruction, you incorporate technological tools into these activities. A “content specific technology”, (i.e., technology used for a specific content area) might be, for example, using many of the newer web 2.0 tools, like blogs, wikis, podcasts and video podcasts (van Olphen, 2006). The main benefit of using different web 2.0 tools is that they have social interaction built in – an important element of language learning. As Warschauer (2002) stated, there has been a movement from using computers and technology as a tutor to that of a tool. A tutor teaches students a language through

interactions, providing feedback to students on correct and incorrect answers. A technology tool assists language learners to create or use language productively, in the vein of a word processor or audio recorder.

With changes in technologies, the definitions for what it means to be literate in a language also changes. Warschauer comments on the need to be literate in the use of e-mail, because of its prevalence in 2002; today different forms of web pages (blogs, wikis and other online text composition sites) (Warschauer & Grimes, 2008) would also be a form of literacy. In other words, Warschauer (2002) suggests that students would need to understand how to read and work with blogs and other web-based tools as a different form of writing from many different kinds of print media, the same way that newspapers and novels are different styles of text.

Web-based tools create technologically mediated activities, which, while similar to previous forms of writing, are also subtly different. It is these tools and other technological activities, which require different kinds of knowledge on the part of the teacher (Warschauer, 2005). For example, to effectively use a wiki in a second language classroom, not only would L2 teachers need to know personally how to use the wiki (technological knowledge, technological content knowledge), but teachers would also need to know about issues dealing with privacy and security (technological pedagogical knowledge) as well as methods for teaching and assessing writing on a wiki (TPACK). This amalgamation of skills needed to use the technology for the content and within the pedagogical construct to teach a language would be a part of second language teacher education TPACK. With a clearer understanding of the TPACK framework, I will continue with a description of the knowledge-base of second language teacher education.

Knowledge-base of language teacher education. The knowledge-base of second language teacher education has changed dramatically as a result of the sociocultural turn. More recently there has been a movement to incorporate all languages (i.e., first, second, third) into the knowledge-base, hence the name language teacher education (LTE) (Firth & Wagner, 1997; Freeman & Johnson, 1998). I will discuss briefly the history which includes the rationale for the sociocultural turn, and some of the changes which have been relevant to LTE.

History. Starting with the history, there has been a dynamic interplay between different groups of researchers who argue for or against Shulman's (1986) balance of pedagogy and content knowledge. Yates and Muchisky (2003) criticize Donald Freeman and Karen Johnson (1998) for too much of a focus on pedagogy and context and little or no discussion of content. Reminiscent of Shulman's critique of teacher education in the late 1980s, they claim that the focus has shifted too much toward pedagogy and away from a focus on content. Yates and Muchisky suggest that Freeman and Johnson ignore language acquisition in many different parts of their research. In a telling quote, Yates and Muchisky say "[t]he call for reconceptualization privileges knowing how to teach over knowing the disciplinary knowledge" (p. 145). They are particularly concerned with a push by Freeman and Johnson towards what they see as a focus in their reconceptualization on too much pedagogy.

In their rebuttal, Freeman and Johnson (2004) discuss the misconceptions of authors like Yates and Muchisky (2003) regarding their reconceptualization. They argue that their reconceptualization is not meant to remove language from the formula for research on second language teacher education and second language education in general,

but it is meant to shift the focus from the field of second language acquisition to one which addresses the social nature of acquisition of language within the dynamics of the classroom and school setting. In terms of Shulman (1986), this is attempting to balance pedagogy and content.

In their original article, Freeman and Johnson (1998) discuss the history of the second language education profession and how there has been a deconstruction of the act of teaching into component parts which do not include the notion that teachers themselves come from the experience of having been taught. They argue that second language teacher education needs to follow the lead of general education and acknowledge that:

teacher [candidate]s are not empty vessels waiting to be filled with theoretical and pedagogical skills; they are individuals who enter teacher education programs with prior experiences, personal values and beliefs that inform their knowledge about teaching and shape what they do in their classrooms. (p. 401)

Shulman (1986) understood this notion that teacher candidates bring something with them and he felt that it was important. As he says, “[t]he teacher is capable of reflection leading to self-knowledge, the metacognitive awareness that distinguishes draftsman from architect, bookkeeper from auditor” (p. 13). He goes on to say that this knowledge and reflection on their profession, makes the teacher a professional.

Freeman and Johnson (1998) also take issue with the focus on content, saying that pedagogical programs around the country have too much emphasis on language learning. At that time, they found that many of the programs of study in universities around the

country include courses on "...phonology, morphology, syntax, applied linguistics and theories of second language acquisition" (p. 403). These programs perpetuate the notion that a person only needs to know the structures of English in order to be a qualified teacher of the language. In their reconceptualization, they focus on three areas: the social context (schools and schooling), the teacher as learner, and the pedagogical process of language teaching and learning, which is broader than what second language teacher education and pedagogical content knowledge have been in the past. For a clearer understanding of how Freeman and Johnson's (1998) reconceptualization works within Shulman's (1986) pedagogical content knowledge, I will examine the framework more closely.

Updating SLTE to LTE. The knowledge-base of SLTE has expanded and even moved away from second language teacher education to language teacher education (LTE) (Burns & Richards, 2009; Crandall, 2000; Johnson, 2016; Kubanyiova & Crookes, 2016; Kubanyiova & Feryok, 2015). The idea of second language implies that it is somehow different than a primary language. However, with learners of second languages occurring in many different situations, including some whose use of the second language becomes primary, the notion of focusing on it as a second language has become of less importance than language learning and teaching regardless of the experiences and use of the language user. Still, the focus has remained on the three critical issues which Freeman and Johnson (1998) pointed out nearly 20 years ago: the teacher as learner, the role of the context of schools and schooling and the activity of teaching and learning.

The role of the teacher as an individual in the learning process and as a "reflective" teacher who will continue to learn during the course of their years of teaching

is an important aspect of LTE (Johnson, 2016), as it was when Freeman & Johnson, (1998) reconceptualized it nearly two decades ago. This reflective notion has led to the idea that teachers contribute to their practice through their prior experiences, interactions and other internal processes which influence their reactions to new information and their use of theories that they may espouse. These have come to fall within two terms on which I will now focus: teacher identity and teacher cognition.

Teacher identity is a constant re-identification of self in reaction to forces or to others which influence the self (Hallman, 2015; Pennington, 2015). It is a process through which the teacher defines the self, either from reflection and interaction with their audience(s) (Hallman, 2015), or as a response to the various contextual and professional discourses in which teachers have to create identities in the context of schools and schooling (Pennington, 2015). Throughout this identification, the idea that the use of technology in their personal and schooling experiences would also be a portion of their identity would not be unreasonable.

In fact, this notion is not ignored by researchers in the area of teachers and their use of technology. Ertmer (2005) over ten years ago discussed similar notions while suggesting that teacher-learners would not have had much experience using technology in the classroom. This lack of experience influences teacher identity which in turn influences choices made in the classroom and their ideas regarding new technology-based pedagogical practices. She states, “teachers are likely to think about technology in the same way they think about other teaching methods, tools, or reform initiatives, depending on if or how they classify technology into one of these categories” (p. 30). And whether they classify it as a tool, or an activity will influence how they use it in the classroom.

This would still hold true, even though teacher-learners are likely to have much more experience with teachers using technology today than 10 years ago. But as Johnson (2015) suggests (not speaking specifically about technology use), this will not be limited to their teaching experiences with technology, but include personal experiences as well.

Research by Attia (2014) supports the idea of the notion that teacher experiences and identity influence pedagogical choices with regards to technological use. They suggest that while teachers come to their professional experience with varied backgrounds with technology use, they need to be reflective and address their personal cognitive needs in regards to its use in the classroom. “[T]he most successful ICT [information and communication technology] integration is that which emerges from individual teachers’ constant examination of their practice and continued commitment to improving it” (p. 14).

Teacher cognition, however, is “what language teachers think, know and believe” (Borg, 2006). These are the processes which a (language) teacher uses to understand and make decisions about how they are going to teach in a particular situation. Johnson (2016) is referring to teacher cognition when she discusses the changes in teacher education from focusing on English language teaching (ELT) practices (what they do) to focusing on teacher reflection and how teachers think about what they should be doing. Language teacher cognition plays a strong role in how teachers make decisions about what to do in a teaching situation. Previous experiences and domains like teacher identity would also influence it. Language teacher cognition would play a significant role in how teachers determine if and how they would use technology in the ELT classroom.

One aspect of teacher cognition is intentionality. Intentionality is an important aspect of cognition as it is related to emotion, motivation and even the development of agency (Kubanyiova & Feryok, 2015). Through intentionality, students and teachers develop shared activities and goals. Kubanyiova and Feryok suggest that “student learning is essentially about how teachers develop shared intentions with their students through joint attention and cooperative communication in collaborative activity during instructed learning” (p. 439). This intentionality of teachers is, therefore, reflected by not only their statements, but also by how they interact within a given class. Intentionality can lead us to conclusions about teachers’ cognition in regards to teaching and even the use of technology. For example, a teacher may say that they have improved their teaching through the use of technology in the classroom, making it more lively for the students in the class. However, observation may show that the teacher still uses many techniques that he had previously used from a teacher-centered perspective, and may not be engaging the students in more productive activities as a result. His lack of understanding of the changes which provide students the possibility of more student-centered learning activities and the allowances of technologically mediated activities of enabling such activities, therefore, shows that he has a somewhat limited knowledge of the potential of technologically mediated activities in the language learning classroom.

Context is still an important aspect of the knowledge-base: it informs the needs of teacher educators in how they will assist the development of teacher identity and cognition to prepare teacher candidates for the beginning and, hopefully, continuation of their teaching career. Johnson (2015), when speaking about the development of teacher

cognition, tells how the context of the teaching situation plays an important role in determining the needs of LTE. She states that:

[i]t requires that teacher educators establish locally appropriate professional development goals that fulfill teachers' needs in the particular instructional contexts in which they are teaching or will eventually teach.
(p. 516)

This 'locally appropriate professional development' should include anything in the context of the schools and schooling at the particular location, which Sharp (2014) suggests could include technological influences in the context.

Johnson (2015), in her discussion of Vygotsky's *obuchenie*, the dialectical process wherein teacher-learners and teacher educators work through the needs of the former and the processes that the latter will use to help them develop their needs, relates to how teacher-learner prior knowledge can both assist and interfere with acquiring pedagogical knowledge. As she says:

L2 [second language] teachers typically enter the profession with largely unarticulated, yet deeply ingrained, everyday concepts about language, language learning, and language teaching based on their own L2 instructional histories and lived experiences. (p. 517)

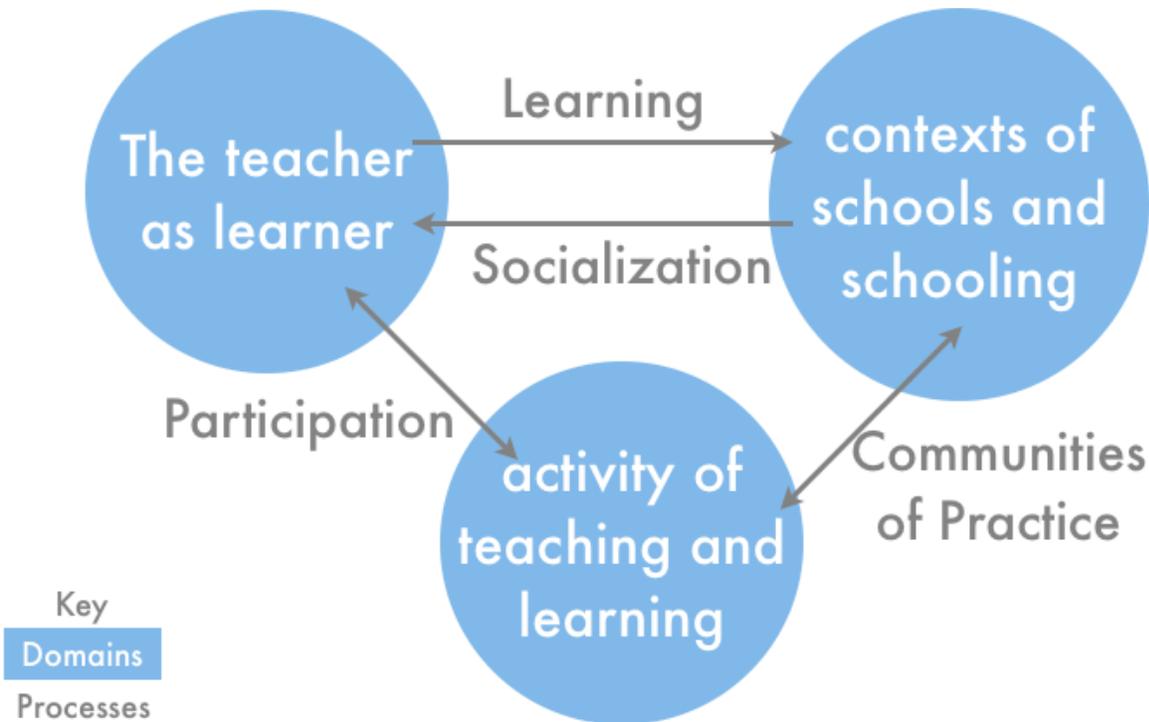
She goes on to tell about how teacher educators will then have to "overcome the inertia" of the prior knowledge of the teacher-learners. Relating this back to TPACK, teachers' personal experiences with using technology, or rather their experiences in learning with technology, may be a limiting factor in their ability to use it effectively in the classroom. While this may change as more students are taught using technology, the influences of

unprepared teachers or under employed technologies in language and other classrooms will have its effects on teacher-learners. This same challenge is a part of the challenge with technology use in ESOL classrooms.

Creating a new technologically enhanced framework based on Freeman and Johnson's (1998) reconceptualization. Though much has changed since 1998, there has not been any update to the knowledge-base framework developed by Freeman and Johnson (1998). When they created their reconceptualization of the knowledge-base of SLTE, they created three domains and four processes (see Figure 2-2). And while I will primarily be focusing on the first domain, I will present the other two here as well: (a) the nature of the teacher as learner, (b) the activity of teaching and learning and (c) the context of schools and schooling. The processes are the following: 1) learning, 2) socialization, 3) participation and 4) creating communities of practice. This review has already mentioned these domains, but this section will describe the domains in more detail and connect them with PCK in order to incorporate the TPACK framework.

Domains of the knowledge-base. As seen in Figure 2-2, Freeman and Johnson (1998) have three domains in their definition of the knowledge-base. The three domains are the nature of the teacher as learner, the context of schools and schooling and the activity of teaching and learning. In this section, I will discuss these three domains in more detail, linking them with Shulman's (1986) pedagogical content knowledge.

Figure 2-2: Framework for the Knowledge-Base of (Second) Language Teacher Education (based on Freeman & Johnson, 1998, p. 406).



Domain 1: The nature of the teacher as learner.

Freeman and Johnson (1998) point out that the main point of second language teacher education is to prepare teacher candidates for teaching second language learners, as opposed to preparing teachers as second language learners. The switch, according to Freeman and Johnson, is an important one, because teacher candidates already come with ideas as to what teaching a second language is about, especially if they have learned a second language in school. According to Freeman and Johnson,

[c]orrecting the view of who the learner is in this process is a critical conceptual step. The knowledge-base of language teacher education must account for how individuals learn to teach and for the complex factors, influences, and processes that contribute to that learning. (p. 407)

With the realization that the teacher candidates have their own conceptualizations of what the process of teaching is, and their own notions of what good teaching should look like, teacher educators may find it more difficult to just tell teacher candidates what they should be doing in the classroom. Freeman and Johnson have found four points of focus for teacher education research: “(a) the role of prior knowledge”; (b) “[how] teacher knowledge develops over time”; “(c) the role of context in teacher learning”; and “(d) the role of teacher education as a form of intervention in these areas” (p. 407). With these areas of focus, it is clear that understanding teacher candidates and their experiences is as important as teaching them the propositions of second language instruction. However, as Freeman and Johnson state, it is also important to focus on “the sociocultural contexts... [where] these processes take place...” (p. 408).

The teacher as learner, as devised by Freeman and Johnson (1998), is somewhat similar to Shulman's (1986) discussions of case knowledge. For him, cases can be used as “*Prototypes*”, “*Precedents*” or “*Parables*” (p. 11, emphasis Shulman’s), and they provide examples from which teachers learn about teaching. As he says,

[k]nowledge of how a particular teacher taught a particular lesson, or the way a teacher brought a classroom of misbehaving youngsters under control sticks in our minds. These remembrances of teachings past are valuable in guiding the work of a teacher, both as a source for specific ideas and as a heuristic to stimulate new thinking. (p. 11-12)

From this passage emerge the beginnings of the ideas of the reflective practice which Freeman and Johnson (1998) consider an important part of the teacher as learner.

However, even more important, is the continuance of this reflection into their practice as

a teacher. This continuation is what Shulman (1986) calls strategic knowledge: “[s]trategic knowledge must be generated to extend understanding beyond principle to the wisdom of practice” (p. 13). Focusing on how teachers as learners work in the social context of the school will be the next topic.

Domain 2: The context of schools and schooling. According to Freeman and Johnson (1998), schools are not a place to simply implement teacher educational practices, but in their words “schools and classrooms function as frameworks of value and interpretation in which language teachers must learn to work effectively. They are the sociocultural terrain in which the work of teaching is thought about, carried out, and evaluated” (p. 409). Hence, the notion that teacher candidates can be prepared so that they can step in and teach, without any further development or training is contrary to the reality of working in a modern classroom. Teacher candidates need to be prepared to develop their teaching over time, or apply praxis, where the teacher’s research on practice influences their own practice, which then furthers their research.

For Shulman (1986), the context of schools and schooling would be an area ripe with possibilities for constructing case knowledge. While cases may be used in the reflective learning of teacher candidates (i.e., in the teacher as learner), they need to be developed somewhere, and the prime location will be in classroom situations. Not only does the context of schools and schooling provide information for practice, but it also provides information for research.

But more than that, the context of schools and schooling is a dynamic which cannot be duplicated in a teacher education setting. There are various dynamics of schools which require certain actions by the teacher every day – taking attendance,

administering a test, or preparing for a field trip – which would not generally be considered activities of teaching and would vary from school to school. Still, these contextual activities are just as much a part of the entire teaching experience as the planning and preparation for instruction and the actual teaching of students to learn a new language.

Domain 3: The activity of teaching and learning. The third domain developed by Freeman and Johnson (1998) argues, “any understanding of teaching must be anchored in examinations of learning and learners” (p. 409). They state that very little has been discovered in classroom-based research. While it may have been true in 1998, there has been progress in this area since then. For example, Foster and Ohta (2005) have done some very interesting research on negotiation for meaning. Their classroom-based research suggests that negotiation for meaning, the process through which language collaborators “mark” language communication challenges, is less important than maintaining a collaborative discourse, which may include many different processes to encourage continued communication rather than focus on challenges. Their research may be a part of the changing discourse as a result of the reconceptualization that Freeman and Johnson started.

Freeman and Johnson (1998), however, suggest that the difficulty in the activity of teaching and learning is the distinction between content and context. The learner in this context also needs to be examined, and Freeman and Johnson indicate that it is important to understand the learner not only in the individualized context of SLA, but also “from the standpoint of socially negotiated, constructivist processes that may be at play” (p. 411). According to Foster and Ohta (2005), the context helps to understand not

only the purpose behind a discourse, but may help give a better understanding of reasons why a language learner might use a particular phrase. For example, from their review of literature, they suggest that some “clarification requests” may be simply the interlocutor pausing for time, or encouraging the other interlocutor to continue speaking and provide more details. Careful discourse analysis needs to consider more than just what was said, but the purpose behind it within the context of the situation.

Again, Freeman and Johnson (1998) assert that a “social constructivist view of language learning” and the “development of teaching knowledge” is more closely related to classroom contexts in which teachers will find themselves, and that it provides a better definition of what needs to be in the knowledge-base. They indicate, therefore, that much of the research in second language acquisition is not as relevant to the teaching context because of the focus on how individuals learn in isolation, rather than learning in context of a classroom.

Finally, teacher knowledge is an important component of what the teacher candidate brings to the teacher education program. Freeman and Johnson (1998) assert that teacher candidates “must be fully aware of and develop a questioning stance toward the complex social, cultural, and institutional structures” (p. 411) which they will need to be familiar with when they become teachers. They state that only through understanding themselves can teacher candidates accept how new research-based knowledge will help them develop new strategies and practices for their teaching career.

While the activity of teaching and learning is focused, at least somewhat, on how the teacher candidate learns how to teach, it also focuses on the processes that the teacher engages in when students learn a language. This domain is where most of the theoretical

knowledge about language learning in the context of the classroom can be generated, and it provides the basis of Shulman's (1986) propositional knowledge. Shulman posits that propositional knowledge is composed of “*principles, maxims and norms*” (p. 11, emphasis Shulman’s). For Shulman, principles are knowledge, which has been empirically proven; maxims are practices, which are difficult to prove empirically (but are usually equally important); and norms are values, which are important for teachers to know about and use. While all these kinds of knowledge can be demonstrated through the use of case knowledge, the propositions themselves form the body of the activity of teaching and learning.

Taken as a whole, one can see why Yates and Muchisky (2003) had such disagreements with Freeman and Johnson (1998). Second language acquisition (SLA) is barely mentioned in Freeman and Johnson’s discourse. The knowledge-base of second language teacher education (SLTE) seems to have a tenuous basis for language learning. Freeman and Johnson (2004), however, indicate that this focus on content knowledge misses the point that in order to understand the needs of language learners and teachers, SLTE teacher educators need to move beyond how students learn a language in isolation and focus on all the elements of the social context of the classroom and school which teachers need to learn in order to be successful. They affirm that SLA would be an important part of the activity of teaching and learning, one of their domains, as it provides some interesting information regarding language learning in specific contexts. But it is only a part of this activity. The domain would also include other socio-cultural elements which are only provided in a language rich classroom, and which a teacher will have to learn how to implement to become successful second language teachers. There

are also other domains just as important that SLA does not even consider. At this point, I will examine the processes which connect the domains in Freeman and Johnson's (1998) reconceptualization, and then how the addition of technological knowledge has allowed for changes in second language teacher education.

Processes of Freeman and Johnson's knowledge-base. Freeman and Johnson's (1998) knowledge-base of TESOL contains three domains: the nature of the teacher as learner, the context of the school and schooling and the activity of teaching and learning. Each of these domains is connected by processes: between the context of school and schooling and the activity of teaching and learning is the process of communities of practice. Between the domains of the teacher as learner and the activity of teaching and learning is the process of participation; between the domains of the teacher as learner and the context of school and schooling are two unidirectional processes of learning and socialization (See Figure 2-2).

Communities of practice. The process of communities of practice connects the domains of the context of schools and schooling and the activity of teaching and learning (Freeman & Johnson, 1998). Communities of practice is a phrase coined by Lave and Wenger (1991) with their discussion of situated learning in legitimate peripheral participation. The idea behind legitimate peripheral participation is to develop a community in which new members can be trained through a kind of apprenticeship program. In their examination of apprenticeship programs, Lave and Wenger (1991) found that successful communities had a way of developing appropriate behaviors and practices through legitimate peripheral participation, where new members of the

community would learn first by watching and then participating in successively less peripheral ways because their participation became more accepted by the community.

Freeman and Johnson (1998) use the process of creating communities of practice between the domains of the activity of teaching and learning and the place of schools and the process of schooling. Communities of practice work within school contexts so that teachers develop an understanding of practice within the school – both within the classroom and within the school – around the activity of teaching and learning. The authors suggest that these school communities need to be examined by researchers to understand what elements of the community are contributing to the successful development of learning situations both for students and teachers, to be able to further their skill in the teaching/learning experience. Therefore, the activity of teaching and learning is a domain that is embedded within the community of practice of the domain of schools and the context of schooling.

Participation. Participation is a bidirectional process that connects the domains of the activity of teaching and learning and the teacher as learner (Freeman & Johnson, 1998). For Freeman and Johnson, learning to teach is a process that can happen only through a participatory event. They state that “[l]earning to teach is a long-term, complex, developmental process that operates through participation in the social practices and contexts associated with learning and teaching” (p. 402). In other words, participation in a learning environment (or a community of practice) is a necessary state for teachers to gain knowledge and experience regarding teaching practice. Teachers must embed themselves within the community of the school and schooling and participate in the activity of teaching and learning.

Socialization. Socialization is the process by which teachers become aware of the teaching process through their years of learning in school. Teachers are also socialized once they return to the classroom, in regards to their new schooling environment and their place within it. In this way, the teacher as learner is constantly being socialized into a different context of schooling, as the situation changes. This socialization is a part of the community of practice and a part of their participation within the school context (whether as a student or a teacher) but it is also socializing teachers and students to the notion of what a teacher is. Freeman and Johnson (1998) also relate socialization into the context of school and the process of schooling to three similar notions: Lortie's (1975, as cited in Freeman and Johnson, p. 406) "apprenticeship of observation" which discusses how teachers learned about teaching when they were students; Denscombe's (1982, as cited in Freeman and Johnson) "hidden curriculum [and]... the sociocultural norms and values emphasized by schools" (p. 406); and finally the notion of "the relationship among home, community and school expectations" (p. 406), which can be different for diverse students or teachers and has been studied by many (see for example Córdova, 2004; Duff, 2002; Ernst-Slavit, 1997; & Oropeza, Varghese, & Kanno, 2010).

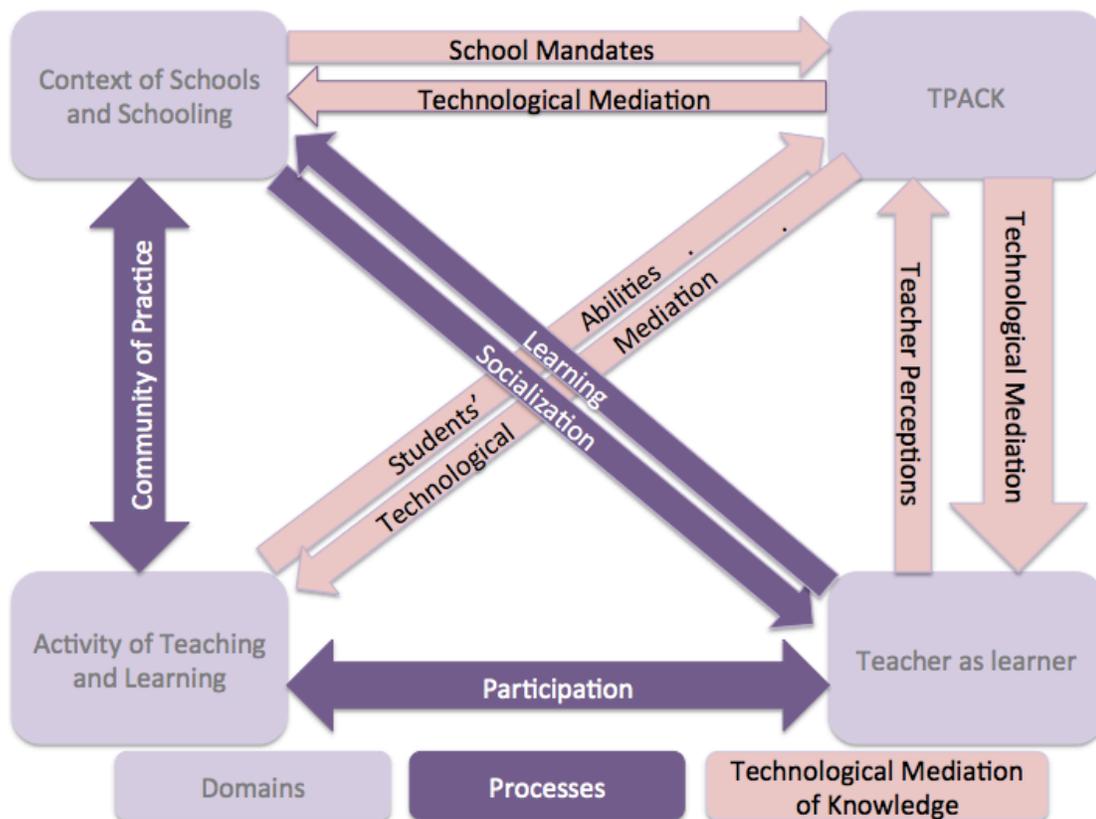
Learning. Learning is what the teacher is supposed to bring into the classroom. From Freeman and Johnson's (1998) view, learning is a process which can be enabled and furthered through the assistance of a language teacher. However, more important in the idea of teacher education is the notion of teacher learning, which Freeman and Johnson categorize into four areas: 1) "prior knowledge", 2) "develop[ment of teacher knowledge] throughout their careers", 3) "the role of context", and 4) "teacher education as a form of intervention in" the above (p. 407). So, in this sense, learning is what the

teacher brings to the context of schools and the process of schooling. It is through their learning that teachers can teach in the classroom, suggest changes in the schooling environment and respond to the needs of the diverse population of students which they encounter on a daily basis.

While the framework developed by Freeman and Johnson (1998) is useful, it does not address the notion of innovation and the need to prepare teachers for it, and in later comments Johnson (2006) still does not make any mention of technological education. Research (Butler-Pascoe, 1997; Egbert, 2006; Egbert, Paulus, & Nakamichi, 2002; Hubbard, 2008; Kessler, 2006) has shown the importance of providing teachers with practical experience with technology, and the knowledge-base should incorporate such important concepts.

Addition of TPACK with the second language teacher education knowledge-base. In order to combine TPACK with the second language teacher education knowledge-base, there needs to be an addition of a fourth domain and processes which connect this domain to the preceding three domains within the framework (see Figure 2-3). The fourth domain would consist of the complete TPACK framework and the processes which connect it to the knowledge-base. I will collectively call them the technological mediation of knowledge.

Figure 2-3: Technology Enhanced Language Teacher Education (TELTE)



Domain 4: Adding TPACK to the knowledge-base. To better understand the

influences technology can have on second language learning, the knowledge-base created by Freeman and Johnson (1998) needs to be expanded (see Figure 2-3 above). Since the development of their framework, there has been considerable research in the area of computer assisted language learning and teacher education (Bax, 2003; Egbert et al., 2002; Hegelheimer, 2006; Hubbard, 2008, 2009; Kern, 2006; Kessler, 2010; Kessler & Plakans, 2008; van Olphen, 2006, 2007; among others). Warschauer (2005) and others (Chao, 2006; Debski, 2006; Hanson-Smith, 2006; Meskill, Anthony, Hilliker-VanStrander, Tseng, & You, 2006; Motteram, Slaouti, & Onat-Stelma, 2013; Slaouti & Motteram, 2006) have taken the idea further by discussing the use of technology from the sociocultural perspective, and Warschauer (2005) particularly discussed how technology

mediates writing activities. Warschauer also discussed how through activity theory by Vygotsky (1981 as cited in Warschauer, 2005) and Leontiev (1979 as cited in Warschauer, 2005), teachers use technology in an educational setting, creating technologically mediated activities, which are different from those activities without the use of technology. Activity theory is a framework which analyzes teaching processes through the use of tools (e.g., technology, media or language itself), subjects and objects, and how they mediate activities. He says that mediation:

helps us understand how new technologies can transform prior forms of human activity. For example, we do not now have a traditional form of writing plus the computer, but rather we have entirely new forms of writing that need to be taught in their own right. (p. 42)

A reasonable extension of Warschauer's (2005) proposition would be that technology could also mediate instructional activities in the classroom, in teacher education and in the contexts of the school as well as the knowledge of the teacher as learner. Research (Chao, 2006; Meskill et al., 2006; Slaouti & Motteram, 2006) discussed later in this review supports this notion. Because of this idea of mediation, it would be difficult to incorporate technological knowledge as a part of any one of the three existing domains within Freeman and Johnson's (1998) knowledge-base (domains of the context school and schooling, the activity of teaching and learning and the teacher as learner). I would propose, therefore, the simple addition of technological knowledge and TPACK framework to Freeman and Johnson's knowledge-base with technological mediated processes which show how this new domain influences other aspects of the knowledge-base. As I will discuss below, and as Warschauer proposes, each of these

domains will be mediated in some way by the addition of the new and innovative technologies within it.

Warschauer (2005) and others (Chao, 2006; Meskill et al., 2006; Slaouti & Motteram, 2006) suggest that technology has a mediating effect on how teachers interact with their environment; therefore the additional processes of technological mediation of the newly incorporated technological knowledge into the three domains of Freeman and Johnson's (1998) knowledge-base would influence each domain in similar but different ways in how they interact with a fourth domain in this new framework. The three domains of Freeman and Johnson's knowledge-base and a technological domain from Koehler and Mishra (2005) would then form the four domains of this composite framework. The processes, which are related to Warschauer's (2005) idea of technological mediation of knowledge within the knowledge-base, will be covered next in the discussion of processes.

Processes: Technological mediation of knowledge. Earlier in this review I mentioned that this alternative framework would add one additional domain, TPACK, consisting of several processes which as a whole I will call the technological mediation of knowledge (TMK). The addition of the single domain requires the addition of three additional paired processes – processes which connect to the three domains originally created in Freeman and Johnson's (1998) knowledge-base. These processes are all unidirectional processes, and each would be paired with technological mediation, another unidirectional process (see Figure 2-3). The other three processes, coming from the original framework developed by Freeman and Johnson are also unidirectional: school mandates (context of schools and schooling), student abilities (activity of teaching

and learning) and teacher perceptions (the teacher as learner). I will first examine the already existing processes, and how technological mediation is involved within them. Then I will examine each of the new processes which relate to the new domain as mentioned above.

Original processes. As already mentioned, technological mediation of activities has an effect on practices within the classroom (Warschauer, 2005). It would seem reasonable to assume that examining communities of practice within schools that are related to teaching and learning would assist not only in the understanding of practice in terms of the teacher's practice, but also the teacher's practice with regards to using technologically mediated activities – whether they are practice-based or professionally-based (like communication with the administration, colleagues or online professional development). Robb (2006) is interested in such activities, whether they occur in the school or elsewhere. Because these communities link the context of school and schooling and the teacher as learner, Robb, along with Hubbard (2008), both suggest that they are necessary for the development of research relating to the teacher's growth during practice and reflection on practice vis. a vis. the use of technology.

Egbert et al. (2002) pointed out that teachers' practice with using technology was more important than the instruction of teachers using technology. While the implication is that prior knowledge is more important, it does not preclude the possibility that technology, and by extension technology infused instruction, can be learned without guidance. But within the praxis of theories about CALL instruction and CALL practice, teachers can only become aware of best practices for using technology in the classroom, i.e., their participation in these practices. Several authors (Egbert et al., 2002;

Hegelheimer, 2006; Kessler & Plakans, 2008) suggest the need for a contextually-based technological practicum to work toward developing activities which will help teachers develop more practice in using technology in a classroom setting. For these reasons participation is important for the teacher as learner, for both their teaching expertise and their TPACK.

In the same way that teachers' expectations of what constitutes good teaching is socialized prior to education, teachers' attitudes toward technology are also socialized and developed prior to their education as teachers. One finding from Egbert, Paulus and Nakimichi (2002) was that teachers who were most successful with CALL-based activities were teachers who had used those activities prior to their course in the software integration. For this reason, Hegelheimer (2006) and others (Butler-Pascoe, 1997; Hubbard, 2008; Kessler, 2007, 2010) have argued for the need to develop CALL activities throughout teacher training. As a part of this process, teachers need to reflect on their perspectives on technology and think about how their attitude toward or confidence in using technology could become a barrier to their use of technology (Egbert et al., 2002; Ertmer, 1999).

Continued learning is also important in regards to technology. As Prensky (2001) pointed out, and as Lenhart, Simon, and Graziano (2001) have researched, technology is one area that students are likely to know more about than their teachers. The prospect of putting teachers in charge of students and asking them to create activities using computers to foster language learning can be both daunting and scary if the teacher is uncomfortable with the use of computers in the first place. Consequently, Hubbard (2008) suggested that simply training teachers to use the newest technology is not

sufficient, while Robb (2006) endorsed the need for teachers to develop a personal learning network to allow them to continue to develop their technological skills. Learning is a process which goes on all the time, and teachers need to be made aware of avenues for continued training for using technology in the classrooms.

Technological mediation. The first of the new processes in the enhanced model is technological mediation, which relates to each of the existing domains. In each instance, the processes of technological mediation are the influences which come from technological knowledge which mediate activities in each of Freeman and Johnson's (1998) original domains. I have already mentioned that Warschauer (2002, 2005) discusses how technology can mediate various kinds of learning activities to make a product which is similar to, but not quite the same as, something created through a less technological activity. For instance, using blogging tools in a writing activity (whether journal, or another activity) adds the ability of students to comment, but not in the ways that would be expected if the students were using notebook and pencil journals. The variations include using a keyboard and typing the content creating an online site that could potentially be viewed and commented on by more people or perhaps including a management system to allow a teacher to approve comments prior to their being viewed, just to name two. These changes of tools mediate the activities of both the students and the teachers in terms of how they are understood.

The three domains each are influenced by technological mediation. School innovations would usually be influenced in terms of the processes which happen in a school (see Figure 2-4). For example, one change that technological mediation has caused in recent years is how professionals communicate with each other. In the past,

teachers used to communicate via phone or mail, by notes in each other's mail boxes or face-to-face. Today teachers, administrators and other professionals communicate almost entirely via e-mail or text messages when they are not using face-to-face communication. This innovation has both sped up the process of communication by allowing teachers to receive information from around the world almost instantly, but may also have slowed down teachers because of the amount of time that is spent every day reading and responding to e-mail or checking text messages. Generally speaking, technological changes within the context of the school that are not really pedagogical in nature, and related only tangentially to education, may only be considered elements of *technological knowledge* rather than TPACK, in particular. Some of these innovations may be a part of a specific content area, and in that instance they might also deal with that content and therefore, would be technological content knowledge (Mishra & Koehler, 2006).

The second domain which has been influenced by technology mediation is the activity of teaching and learning, which is more specific to the classroom (see Figure 2- 5). One innovation which has mediated how teachers work in a classroom in recent years, is the use of PowerPoint presentations (Cox & Graham, 2009). PowerPoint is now so prevalent that it might no longer be considered a technological innovation, but a part of general pedagogical practice. However, the use of a PowerPoint presentation is different than the ways teachers used to present information, using the chalkboard and overhead projectors. As Cox and Graham have stated, this kind of innovation is something which is on the cusp of TPACK, but since it is used in most teaching classrooms, PowerPoint is an activity which would be used in any content area and, therefore be classified as technological pedagogical knowledge.

Figure 2-4: Technological Mediation of the Context of School and Schooling.

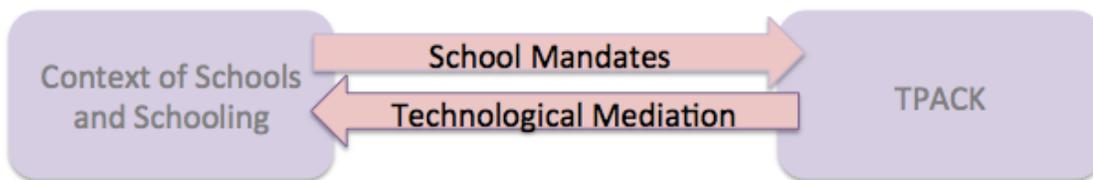
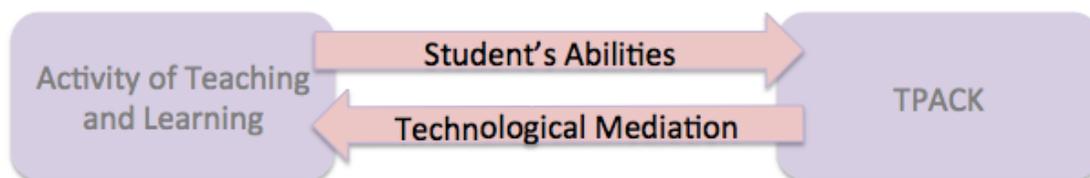


Figure 2-5: Technological Mediation of the Activity of Teaching and Learning.

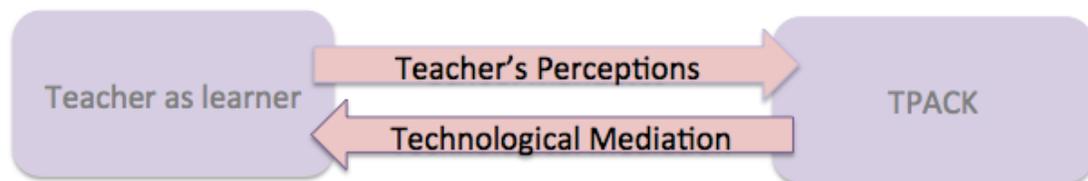


Warschauer (2005) also discusses the notion of “electronic literacies”. The literacies that he discusses are the use of e-mail and the world wide web. Since his writing in 2005, there has also been the addition of social features of online interaction, specifically web pages such as *Facebook*, *Twitter*, *YouTube*, *Pinterest*, *Instagram*, and some which have a more educational focus like *Edmodo*, *Kahoot* and *ClassDojo* (see Appendix A), and many more. All of these would be other kinds of mediation on language use (Grimes & Warschauer, 2008). Back in 2005, Warschauer discussed four elements that he considered important to electronic literacies: computer literacy, information literacy, multimedia literacy and computer mediated communication (CMC) literacy. He defines these elements respectively as “comfort and fluency in keyboarding and using computers”, “the ability to find and critically evaluate online information”, “the ability to produce and interpret complex documents comprising texts, images, and sounds”, and “knowledge of the pragmatics of individual and group online interaction” (p. 455). The addition of a social dimension to web activities has only increased the need for the fourth form of CMC literacy. The need for these literacies in the language

classroom show how technological mediation affects the learning situation of teaching and learning.

Finally, the teacher is also mediated by technological knowledge (see Figure 2-6). Some teachers will attend workshops on innovations which are being used in the classroom. Others may attend online workshops to learn about other classroom practices. Innovations may also be picked up through online learning sites or blogs (Robb, 2006). As teachers learn about these innovations, they make changes to their teaching practice, which mediates the way that students learn in the classroom. Changes in practice incorporate elements of both content knowledge and pedagogical knowledge, and would therefore be a part of TPACK.

Figure 2-6: Technological Mediation of the Teacher as Learner.



Technological mediation can incorporate changes in many different areas – the school environment can be changed through the addition of new administrative practices and technology in the building. Changes in the classroom can come about as a part of a new school-wide initiative, or a training session which is content neutral and may be applicable to different teaching situations. Finally, specific content-based pedagogical practices involving new innovations can be learned at workshops and applied to a specific teaching environment. All of the above change the dynamic of the school setting.

School mandates. The first of the processes that I have added is between the context of the school and the knowledge framework including TPACK (see Figure 2-4 above). This process is organized by the administration, which require teachers to learn new innovations to use in their classroom or other school practices. Engeström (2009) discusses the challenges involved with implementing a kind of technological innovation within a school which was suggested from outside. He examined the processes of an expansive learning model and how a mandated school change influenced teachers' acceptance of and involvement in that change. While in this instance, changes were not challenging just because of the addition of a new technology, the addition of the technology, combined with teachers' perceptions (positive or negative) of this technology, added to the challenges of success. To be successful in an implementation, you have to overcome the negative perceptions and make the change not only acceptable, but preferable to all stakeholders. McKenzie (2000) also discusses the problems with implementing technology integration without considering the needs of the teachers who implement it; he argues for examining the needs of the context of the school when implementing a technological change, and in this way the TPACK framework would be influenced by the context of schooling and the place of schools.

Student abilities. The next processes are those that integrate TPACK with the activity of teaching and learning (see Figure 2-5 above). The same way that technological knowledge is influenced by school mandates, it will also be influenced by the activity of teaching and learning. The activities chosen in the classroom are not only influenced by teachers and their perceptions, but also by the abilities of all the students in their use of tools available in the classroom. Activity theory discusses six different

elements and how they interact. One of these elements is the content area or, in this example, the students and the knowledge that they bring to the classroom (Engeström, 1987). Therefore, what students know about technology (as well as their access to it) will influence activities within the classroom and in turn TPACK.

Prensky's (2001) theories about the digital native posit that digital native students who are in classrooms which are not technologically enhanced may not be as engaged in learning as previous generations. Consequently, teachers should change their practices to better engage students. While Prensky is not universally accepted (Hubbard, 2008), and it would be a fallacy to assume that all students come with the same levels of technological ability (Oxford & Jung, 2007), it is important to consider that technology may be a motivating factor in student learning, which some research has shown to be possible (Alhinty, 2015; Dede, 2005, 2009; Dede, Clarke, Ketelhut, Nelson, & Bowman, 2005; Diemer, Fernandez, & Streepey, 2013; Flower, 2014; Larabee, Burns, & McComas, 2014; Mango, 2015). Therefore, students may be excited by the use of technology, at least initially, and request its use in situations which teachers might not consider during planning – which would affect how teachers use technology in the classroom. Or students may be incapable of using a particular technology and would either need to be trained in its use, or the teacher may have to consider not using it because of the students' abilities.

Teacher perceptions. Finally, the last processes relate TPACK with the teacher as learner. Teachers' perceptions (see Figure 2-6 above) about technology, the benefits of technology and its purposes in learning influences how technological knowledge is mediated by the teacher as learner. Many researchers (Egbert, 2006; Egbert et al., 2002;

Hubbard, 2008, 2011, Kessler, 2007, 2010; Kessler & Plakans, 2008) have discussed how changes in technology necessitate changes in practice, as well as how teachers perceive such technological changes and how these changes influence their practice.

Developments in technological innovations and technological knowledge influence how the teacher as learner perceives technology and what kinds of technology might be useful for instruction. Ertmer and others (Ertmer, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012) discuss how teachers' beliefs can influence their use of technology in the classroom. She also mentions how teachers' beliefs can become a barrier to technology use, if they feel it is a burden or not practical. Without the desire to use technology, school mandates and students' needs will not allow teachers to use technology in a way which is productive. Therefore, the teacher as learner is still the most important aspect of the equation for successful use of technology in the classroom, and this study will look most closely at this domain.

CALL in teacher education

This second section of the literature review has to do specifically with how adding technological knowledge to the language teacher education (LTE) knowledge-base changes how we approach research and education in the LTE field. In order to pursue this notion, I will examine how current research represents technologically enhanced language teacher education (TELTE) and discuss where there is a need for further research. Also, I will examine the current research field regarding the need for implementing TELTE in teacher training and what teacher educators need to accomplish.

Understanding TELTE research. Technologically enhanced language teacher education is a phrase I am coining to represent the difference between the CALL field

and the language education field related to CALL. This is somewhat related to the dichotomy between the language teacher education field of research and the ELT or English language teaching field of research. The overall goal of both is to improve instruction in language teaching, but one focuses on the education of the teachers, and the other focuses on the education of the English language learner (ELL).

CALL is a research and practice field which is closely related to technologically enhanced language teacher education (TELTE). It examines practice and research in using computers to teach language learning. LTE for CALL is actually a fairly young field, or perhaps better considered a subfield of CALL, which has only been active since around 2002 (Motteram et al., 2013). Still, since 2002 there have been several articles on LTE and CALL, including a book by Levy and Hubbard (2006), *Teacher Education in CALL*. Looking at CALL research specifically related to teacher education will help with the examination of the TELTE research base. First I will look at the research-base for TELTE, and then I will look for gaps in the research base for TELTE.

The research-base. Several areas might be included in the research base for technologically enhanced language teacher education (TELTE). This review will try to cover a range of them in terms of empirical research. These areas include: research related to the TPACK field, studies related to the support of teachers developing TPACK in pre-service programs, challenges related to the TPACK framework, a discussion of how teacher beliefs affect technology use, a look at TPACK knowledge growth, some research looking at integrating CALL into the teacher education field, an exploration of research which combines second language learning and TPACK and, finally, a look at sociocultural theory in relation to TELTE.

TPACK. In their introduction of TPACK, Koehler and Mishra (2005) discussed the need to integrate technological knowledge with Shulman's (1986) PCK framework, with the idea that technology should be a form of knowledge that is "important, but not separate and unrelated from contexts of teaching" (p. 132). They proposed their framework, which integrated the three areas of knowledge, two discussed in Shulman's work, and the third, technological (as discussed earlier). Mishra and Koehler suggested that the importance of understanding technological knowledge was in how it affected – or mediated – the other kinds of knowledge that are necessary in the field of teacher education.

Koehler and Mishra's (2005) research discussed if teacher candidates developed TPACK as a part of a "learning by design" course, where teacher candidates focused on creating an online course for use in their master's of education program. The four faculty members worked together to design the course, using many different kinds of online tools, depending on their particular foci and interests. The procedure requested that the participants complete a survey four times, with an attempt at keeping the surveys anonymous. More significant in terms of the model, it addressed the way teacher candidates "think... about how technology... is related to teaching and learning... for the content area" (p. 144). Teacher candidates' perceptions of the differences between an online course and a face-to-face course changed from thinking about minimal differences, to the notion that "online courses require more time; teaching online courses requires a changing of content and pedagogy" (p. 144).

The results of Koehler and Mishra's (2005) research showed that teacher candidates' attitudes changed dramatically from week 4 to week 13, in their perceptions

of time and effort, learning and enjoyment, and working together as a group. The reasons were their gradual acceptance of the design course and eventual recognition of the method of instruction as effective (though not recognizing it initially as such).

The study presented by Koehler and Mishra (2005) has strong indications in terms of the TPACK framework. It indicates that through the use of teaching online course design, teacher candidates can appreciate the differences needed when integrating technology into a content-based pedagogy. Consequently, because teacher candidates were able to come to this realization themselves as a part of the design course shows that it is a significant conclusion and supports the framework. However, it is just one study, with a small number of participants (fourteen).

TPACK support. There have been hundreds of articles related to the use of TPACK in research and many relating to the support of TPACK or technology integration in non-CALL fields (Chai, Hwee, Koh, & Tsai, 2010; Higgins & Spitulnik, 2008; Pierce & Ball, 2009; Schnittka & Bell, 2009; Trautmann & MaKinster, 2009, to cite a few). Each of these articles focuses on a different kind of support: ICT courses for pre-service teachers (Chai et al., 2010), a detailed teacher preparation program (Schnittka & Bell, 2009), and some kind of professional development (Higgins & Spitulnik, 2008; Pierce & Ball, 2009; Trautmann & MaKinster, 2009). There are usually different kinds of teachers in the studies: pre-service educators using information communication technology (Chai et al., 2010); in-service mathematics teachers (Pierce & Ball, 2009), and science teachers (Higgins & Spitulnik, 2008; Trautmann & MaKinster, 2009).

Much of the discussion centered on the support needed for training (whether pre-service or in-service) teachers to acquire the skills to use the technology in the classroom

(Chai et al., 2010; Higgins & Spitulnik, 2008; Pierce & Ball, 2009; Schnittka & Bell, 2009; Trautmann & MaKinster, 2009). It would be anticipated that many of the ideas presented in the training might be similar from one content area to another and that there might be some differences as well for some content areas and for language instruction in particular. And while there was little agreement between the research studies presented here, it is possible that many of these supports could be identified in multiple areas of instruction. Generally speaking, the ideas of these researchers include supporting the teacher's pedagogical knowledge when developing activities (Chai et al., 2010), giving teachers a chance to discuss their perceptions of technology (Higgins & Spitulnik, 2008; Pierce & Ball, 2009), providing social support for teachers to continue to develop after their training (Pierce & Ball, 2009) and allowing the training and/or coursework to be flexible enough to adapt to the needs of teachers (Trautmann & MaKinster, 2009). While these may be similar across most content areas, there may still be other areas where language teachers or teachers in other disciplines need specific support, for instance the example of the geospatial devices necessary for determining one's location on the planet, relevant to a particular pedagogy which may or may not be relevant to language learning (Trautmann & MaKinster, 2009).

TPACK challenges. Brantley-Dias and Ertmer (2013) have challenged the notion of TPACK as being a useful construct for both teachers and researchers on several fronts. First they challenge the notion that technology is something which is inherently different from other kinds of pedagogical tools. However, they also explain that Shulman discussed many types of tools, some of them technological, and made no distinction.

They believe that the difference between the technological tools he discussed, and others more relevant today, may simply be a matter of a different time period.

Shulman described a teacher's curricular content knowledge as the knowledge of instructional materials that are useful for teaching a certain content including materials such as software, visual materials, and films, among others. Although computer technology was not mentioned specifically, other technologies (software, films, etc.) were, suggesting that if the article had been written a few years later, computer technologies likely would have been included among the list of relevant instructional materials. This is not to suggest that Shulman would have included an exhaustive catalog of specific digital tools in his list of instructional materials, but rather that he would have suggested that teachers needed to understand how different types of tools (e.g., digital probes, graphing calculators, collaboration tools) facilitate the teaching of different types of content (e.g., science, math, social studies) (p. 106).

Through this redefinition of tools, they have complicated Shulman's (1986) PCK framework, by adding four additional knowledge frames or intersections to get at the general idea of creating a TPACK base with a focus on technology. Furthermore, the creation of this framework has created confusion as to its purpose: it was originally created with a research basis, but has also been used to evaluate teachers and their abilities in using technology in the classroom. Finally it has proven difficult to measure TPACK, as there have been "more than 100+... instruments and measurement techniques

developed” (p. 108), according to Koehler et al. (2011 as cited in Brantley-Dias & Ertmer, 2013).

These challenges speak to the complexity of the TPACK framework and the difficulty of creating an understanding of something which is both very complex (i.e., a framework with seven domains), changeable (the very nature of innovation is that there is constantly something new being developed) as well as a construct which is different based on the content of the area under examination (which means that a framework which focuses on second language education will be different than one which focuses on science education). This is the challenge of examining technological education, and the challenge of using this framework within this study.

Teacher beliefs. How teachers use technology may be, at least in part, based on teacher beliefs (Abbitt, 2011; Chao, 2006; Ertmer, 2005; Ertmer et al., 2012; Kim, Kim, Lee, Spector, & DeMeester, 2013; Meskill et al., 2006). Some researchers (Kim et al., 2013) have noted that there are discrepancies in the literature in terms of the definition of teacher beliefs. According to Kim et al. (2013), there are two different kinds of teacher beliefs: one where researchers explore how teachers view pedagogy, and based on their ideas, how their implementation of technology differs; the other view is that teacher beliefs are simply whether teachers believe in the efficacy or importance of using technology, regardless of their pedagogical beliefs. Kim et al. (2013) feel that if you do not include in the discussion of teacher beliefs, the pedagogical beliefs of the teachers, then you will not understand why teachers use technology differently, even if they share beliefs regarding the importance of technology use. As Abbitt (2011) mentions, Bandura (1997) suggests “self-efficacy beliefs are constructed from four principal sources...: [a]

enactive mastery experiences...[, b] vicarious experiences...[, c] verbal persuasion and [similar] ... social influences... and [d] physiological and affected states....” (p. 79).

With mastery experiences being the strongest, “most influential” of these self-efficacy beliefs, a connection is made between knowledge and self-efficacy. This strongest form of self-efficacy is derived from practical experiences which allow persons to develop a sense of success or failure. As Bandura (1997) suggests, the stronger sense of efficacy is derived through a development of progressively more challenging activities which allow the person to acquire the ability to work through obstacles and achieve success. Bandura (1997) here draws a connection between teacher beliefs and knowledge – at least in the sense that beliefs can be formed through practical application and their experiences with knowledge. As Chao (2006) suggested, sometimes experiential beliefs can be a challenge to overturn in order to produce higher quality artifacts for educational purposes. Meskill et al. (2006) go on to reiterate that simply having a positive attitude towards using technology does not ensure competency in its use in the classroom.

By 2005, Ertmer suggested that much of what she considered to be first-order barriers (Ertmer, 1999), or that training and access that teachers need to be successful, were now “in-place” for teachers to use in the classroom. But technological use was still low, which she attributed to the continued existence of second-order barriers (teacher beliefs). Much of the focus, she thought, should then be directed at overcoming these second-order barriers (Ertmer, 2005; Ertmer et al., 2012). However, in 2012, Ertmer found evidence that first-order barriers still existed. More specifically, in their study in 2012, Ertmer et al. looked at a case study of 12 exemplary teachers and found that there was still – even with teachers who were perceived as successful – the indication of some

challenges regarding first-order barriers. The implications are that in regard to those teachers who may still be struggling to implement technology in their classrooms, there are still potentially first-order barriers – most specifically, training – which may make it more difficult for teachers to implement technological activities which match their pedagogical beliefs.

Along the lines of those pedagogical teacher beliefs, Ertmer (2005) and Ertmer et al. (2012) noted three kinds of pedagogical beliefs espoused and practiced by the exemplary teachers that they studied. The three beliefs that were expressed by the teachers, and seemingly espoused in their practices, were: 1) skill building, 2) enhancing learning objectives (through projects) and 3) “transforming learning”. According to the researchers, the teachers in their study felt that their beliefs facilitated integration of technology, while other teachers, perhaps those who had more difficulty implementing technology, were viewed by the teachers from the study as having beliefs which constrained their efforts to integrate technology. These teachers described their peers as “‘afraid’, ‘fearful’, ‘intimidated’, ‘leery’, and ‘reluctant’” (p. 434) in regard to technology use. This supports the notion expressed by Ertmer (1999) and Ertmer et al. (2012) that the second-order (internal) barriers are still the most difficult to overcome.

TPACK knowledge growth. In order to overcome these barriers, teachers need to become more comfortable with the use of technology in their classrooms, as the research by Ertmer et al. (2012) implies. Niess (2011), based on previous work, proposed a way of measuring growth of knowledge of technological use through teacher acceptance and use of technologies in their classroom activities. She suggested five stages for growth: “Recognizing (knowledge)..., Accepting (persuasion)..., Adapting (decision)...,

Exploring (implementation)... [and] Advancing (confirmation)” (emphasis removed, p. 312-3). With an understanding of each of these stages (see Appendix B), researchers could make a developmental comparison for a teacher who is developing knowledge and skill in using technology in the classroom and could make assessments as to where a particular teacher started and how much growth may have occurred throughout their study. Also important for understanding growth is discussion with the teacher and examination of the activities that the teacher has engaged in.

In a similar vein, Harris and Hofer (2011) discuss how implementation of professional development on teacher planning can help teachers develop activities which allow for an increase in their personal TPACK development. While my study will not involve professional development, it seems appropriate to use their ideas involving a discussion of planning to help provide another avenue of examination regarding teachers’ TPACK and teachers’ planning with iPads.

Studies using CALL in LTE. There have been several studies of using CALL as a part of the teacher education program in LTE (Egbert et al., 2002; Hegelheimer, 2006; Kessler, 2010; Kessler & Plakans, 2008). Each of these studies has tracked teacher candidates and teachers in a technology integration (CALL) course for second language teacher candidates, and each has highlighted different effects based on the kinds of teacher candidates and technology integration.

Several of the studies (Egbert et al., 2002; Hegelheimer, 2006; Kessler, 2010) focused on research of teacher candidates in their education courses, with Egbert et al. (2002) also continuing their research post graduation. Kessler and Plakans (2008) also did research regarding teachers in practice at a university setting. Several of the studies

(Egbert et al., 2002; Hegelheimer, 2006) indicated that a single course on using technology was not sufficient to produce its comfortable use. Others focused on the expertise developed by the teachers. While Egbert et al. (2002) suggest that some technological knowledge is needed to continue to use the software or technological innovation after the class, two studies (Kessler, 2010; Kessler & Plakans, 2008) seem to indicate that technological knowledge does not necessarily produce competence in teaching with a technological innovation.

In fact, teachers who were considered only “contextually confident”, i.e., teachers who were only confident in using the technology in the specific context, were more thoughtful about their use of technology and its appropriateness to language learning (Kessler & Plakans, 2008). In the subsequent study by Kessler (2010), participants with a high degree of technological knowledge (TK) did not understand any better than those who had lower levels of TK how to integrate technology into classroom use. There was even some indication that TK proficient teachers did not focus as much on the pedagogical skills needed as they did on the technological. Comparatively, teacher candidates with lower levels of TK (who were generally more interested in using integrated technology) were more interested in the pedagogical focus, once they learned some basics skills.

In Kessler (2010), control is also an important element. Several teacher candidates were challenged when students worked in unrestricted environments and therefore felt the need to control the computer-mediated communication environment while using it with their students. Kessler states that the notion of control is an area where further course design research is needed. This study has a larger group of subjects,

and considerably more data, and provides a more robust example showing (among other things) the importance of integrating pedagogical knowledge and content knowledge with technological knowledge in a TPACK-like framework. Without this integration, teachers are not likely to understand the needs of the teacher candidates for the course that they are designing.

It is also of note that all of the researchers indicate the importance of specifying pedagogical practices for the development of CALL activities (Egbert et al., 2002; Hegelheimer, 2006; Kessler, 2010; Kessler & Plakans, 2008). Egbert et al. (2002) discussed how a single course in using CALL tools was not sufficient to assist teachers to use technology in their classrooms; Hegelheimer (2006) showed how technology can be effectively integrated throughout a particular LTE program; Kessler and Plakans (2008) discussed how individuals with more knowledge of technology did not necessarily transfer this technological knowledge into creative practices of TPACK; and finally, Kessler (2010) also showed that having a higher level of technological knowledge did not ensure that a teacher would be effective in using TPACK.

This focus on understanding the pedagogical purpose of technological integration in CALL indicates an acknowledgement of the importance of the TPACK framework, even without talking about it specifically, by showing that teachers' knowledge of technology, separate from other the field of LTE, may not necessarily guarantee superior TPACK. It is only through the development of the integrated instruction of TPACK throughout a particular program of study that TPACK can be more fully developed. Because of the relatively recent development of the TPACK framework by Mishra and Koehler (2006), and the comparative isolation of CALL from other technology-based

fields of educational research, there has not yet been much research on the similarities of TPACK and CALL or the uses of the TPACK framework in the second language teacher education field. I will examine some relatively recent research relating to TPACK and the use of technology in language learning classrooms in the next section.

TPACK and LTE. TPACK is an interesting framework because of its premise that technology use in a classroom setting is dependent upon the pedagogical and content area needs of instruction. As a member of the CALL community, I found a research-based focus on the use of technology in language learning as separate from other instructional content areas, clarifying and assistive in the way it defines the need for CALL instruction and research. Therefore, it surprised me that there were not more researchers embracing the TPACK framework as a way of distinguishing CALL from other fields of research and pedagogy related to using technology in the classroom. Part of this could be attributed to the relative newness of the CALL teacher education field – although CALL has been a field of research for 30 or more years – perhaps most recently brought to the forefront with the edited volume by Levy and Hubbard (2006).

Since my initial interest in TPACK, there has been a trickle of research related to both TPACK and CALL, or at least language learning and technology. This research has been used primarily as an evaluative tool, with researchers using the TPACK framework to assist in evaluation of teachers' use of technology (Baser, Kopcha, & Ozden, 2015; Chea & Vibulphol, 2014; Kulavuz-Onal, 2013; Lane, 2012; Tseng, 2014; Tseng, Cheng, & Lin, 2011; Xiaobin, L., Lijun, J., Huiwen, Z., & Wei, 2014) or the normalization of CALL and TPACK with teachers (Rahmany, Sadeghi, & Chegini, 2014).

Several researchers have created TPACK based surveys or other instruments for their evaluation of teachers' knowledge (Baser et al., 2015; Chea & Vibulphol, 2014; Lane, 2012; Tseng, 2014; Tseng et al., 2011; Xiaobin, L., Lijun, J., Huiwen, Z., & Wei, 2014). Chea and Vibulphol (2014) used the TPACK framework to validate their survey of key stakeholders to determine the needs of English teachers in Cambodia. Tseng (2014) needed an instrument for evaluation of teachers' use of technology in the CALL classroom, which he balanced among the seven elements of the TPACK framework. Baser et al. (2015) created a survey to assess pre-service teachers' knowledge of using technology to teach EFL, based on the TPACK framework. Tseng et al. (2011) used the TPACK framework to guide a descriptive evaluation of the teachers' knowledge, making this research somewhat different than other research reviewed in this section. Xiaobin, Lijun, Huiwen, and Wei (2014) used the TPACK framework in an investigation of teachers participating in the "National English Teachers Training Project", through the use of surveys. Lane (2012) discussed how a professional development program to assist teachers in using technology, including iPads, in their classrooms was evaluated with their survey of participants.

Rahmany et al. (2014) discussed the normalization of CALL in terms of Bax's (2003, 2011) "normalisation", or the idea that technology will become integrated into language learning activities and that CALL researchers and practitioners "should be aiming at their own extinction" (2003, p. 23), although he later pulled back from this extreme position. In their research, Rahmany et al. (2014) evaluated the way that technology use in the language learning classroom had become normalized through observations, self evaluations and interviews. Normalized would be the goal of the

teachers in this study, and Rahmany et al. (2014) used TPACK as a way to measure this normalization.

Most interesting for my research is Kulavuz-Onal's (2013) evaluation of the Webheads in Action. Webheads are a group of teachers who work with English language learners worldwide and share technological expertise through an online forum. Kulavuz-Onal does a qualitative analysis of Webhead discussions, using frameworks like legitimate peripheral participation (Lave & Wenger, 1991) in a community of online practice, as well as collecting descriptive netnographic data from the discussions she participated in to classify discussions in terms of different elements of the TPACK framework. Her analysis does not make an attempt to evaluate the quality of the discussion, but does use the data to show the development of TPACK through the use of online discussions and presentations, both as part of an online 'course' on becoming a Webhead in 2002, and in subsequent discussions with Webheads in regular meetings afterwards.

From this brief analysis of several recent publications related to TPACK and CALL, the TPACK framework served as more of an evaluative rather than a descriptive or educational framework. While there is generally an element of description built into the programs being evaluated, most of the research used surveys which evaluate the quality of instruction based on the TPACK framework (Baser et al., 2015; Chea & Vibulphol, 2014; Rahmany et al., 2014; Tseng, 2014; Xiaobin, L., Lijun, J., Huiwen, Z., & Wei, 2014). Where other research diverges, it is still somewhat evaluative – looking for ways to describe how teachers use technology in the classroom and relating it back to the TPACK framework (Kulavuz-Onal, 2013; Tseng et al., 2011). This relates back to

one of the challenges associated with the TPACK framework and advanced by Brantley-Dias and Ertmer (2013): the target audience for using the framework. In many of the instances noted herein, the movement from defining practice and policy to describing teachers' abilities is strong (with one significant exception in Kulavuz-Onal, 2013).

SCT and TELTE. Much of the research in CALL and teacher education has been influenced by the field of applied linguistics. However, from the reconceptualization of Freeman and Johnson (1998) in terms of how to approach the LTE field, there has also been some CALL research based on sociocultural theory (SCT) and this reconceptualization (Motteram et al., 2013). This includes the original study by Egbert et al., (2002), as well as several other studies (Chao, 2006; Debski, 2006; Hanson-Smith, 2006; Meskill et al., 2006; Slaouti & Motteram, 2006) appearing in Levy and Hubbard (2006). The authors of these studies recognize the importance of an education-focused approach to the understanding of CALL and LTE (or TELTE) (Motteram et al., 2013).

For example, Egbert (2006) discusses the needs of situating language instruction in contexts which have access to CALL. In these situations teachers learn from the context and broaden their propositional knowledge (in terms of Shulman, 1986) to include cases which allow the teacher-learner to experience how technology can be used in a classroom, something which would have been impossible during the years of their experiences with teaching because of continual technological change. Similarly, Slaouti and Motteram (2006) discuss the four stages of teachers' knowledge change: metacognitive processes and the recognition thereof, reflection on the process of metacognition, reflection on their apprenticeship, and then an assessment of the metacognitive process. It is through this series of steps that teachers achieve

reconstruction of their prior knowledge which has been augmented through the use of technology in the classroom.

Debski (2006) discusses the need for a practical approach to CALL programs. He proposes that course work be a mixture of practical and theoretical tasks to ensure a wide acceptance. The practical is necessary to ensure the application of the ideas espoused, but the theoretical helps students learn how to appreciate what is important about using technology in the classroom and apply it to future technological innovations. As an example of the practical, Chao (2006) discusses the uses of WebQuests and other kinds of technology in the classroom. WebQuests allow teachers to create or use “inquiry-oriented activities” which supports the development of higher-order thinking skills (HOTS). However, Chao also discovered that some teachers were challenged in their use of technology by looking at the kinds of things they might create with new tools. Some of the study subjects created activities without a focus on the use of HOTS, but were primarily focused on responding to factual questions. Also teacher designs often had graphics (like animated GIFs) which were appealing from a design perspective, but had the real potential to distract the learner from the activity at hand – indicating a need to integrate theory into the learning activity to allow teachers to focus on important pedagogical aspects.

Meskill et al. (2006) and Hanson-Smith (2006) both reflect on teacher education practices and the idea of communities of practice. Meskill et al. (2006) discusses that since teaching, especially with the use of technology, is a situated practice, simply teaching the use of technology in a classroom is not sufficient to assist teachers in developing their technological competence. This is best developed through an

apprenticeship model, where teachers' participation in the communities of practice is gradually developed and improved.

This collection of research helps highlight several key points. The first of these points, which several of the authors (Egbert, 2006; Hanson-Smith, 2006; Meskill et al., 2006) alluded to, would be the need to explore and teach the use of technology in the context of instruction. This concept supports the idea of Freeman and Johnson's (1998) reconceptualization, especially the activity of teaching and learning, and the context of schools and schooling. Teachers will get a better grasp of how students will handle the technological aspects of a particular application or activity when they see how students respond to the use of the technology.

Another theme which was developed by several of the authors (Chao, 2006; Debski, 2006; Slaouti & Motteram, 2006) is the notion that teachers need to focus on the content of their technological materials more than just on their appearance. It is important that materials be functional and do not detract from the learning of the students – but they must allow for the development of higher-order thinking skills and be theoretically well situated for the purposes of the learning goal.

Gaps in the research. A weakness in the research is the limited amount of studies regarding the integration of CALL and TPACK. While CALL itself is TPACK for language learning, the use of the TPACK framework in CALL, or at least some LTE studies might create some interesting insights. While there have been a few studies using the TPACK framework with LTE, most of these have been through the development of an instrument to evaluate teachers TPACK for LTE. This is certainly necessary, as Brantley-Dias and Ertmer (2013) have pointed out, and further research in this area

would be useful as it is still new and unclear in terms of how effective the few evaluative surveys are. Beyond the evaluative studies, research to describe different successful elements of TPACK within the LTE field would also be useful in terms of pedagogical purpose, and give CALL research stronger support for some of the most fundamental aspects underlying most prevalent research in the field – that of the integration of technological knowledge, pedagogical knowledge and content knowledge in a cohesive manner within LTE programs (Egbert et al., 2002; Hegelheimer, 2006; Kessler, 2010; Kessler & Plakans, 2008). Koehler and Mishra (2005) even mention that their research is based on one course, so it is limited and that there needs to be further investigation. Conducting a study using the TPACK in the second language teacher education content area would be a logical extension.

However, the research also indicates other gaps. Egbert et al. (2002) see a need for examining how CALL courses can be incorporated into education courses – including increasing the number of courses past a single course. Similarly, Hegelheimer (2006) discusses cross program integration in his “study” and indicates that the more integrated CALL is throughout the curriculum, the more likely teacher candidates will achieve proficiency in its use. However, he indicates several issues with encouraging faculty to participate in such a program, even though his program has had some success. In his discussion of faculty participation, he documents many other issues other than just faculty expertise and buy-in. Although Hegelheimer’s study is promising, it describes just one program, which has had some measure of success, and about which further study would be indicated. Kessler (2010) also indicates that there needs to be further study of teacher education programs, but his focus is more on understanding the needs of a newer

age of language teacher candidates, who have more experience with technology in order to have these teacher candidates be prepared for integrating that technology into their practice.

Egbert et al. (2002) are also concerned with the transfer of learning from CALL education courses to the classroom. Because their research showed that most of the practitioners who were using CALL activities, were those participants who already were using it prior to the course, they felt that – in this instance – the technology course did not prepare their teacher candidates as well as it could have. Again, Hegelheimer (2006) did not seem to agree with this concern, because he felt his program provided teacher candidates with the confidence that they needed to participate in future classroom work – however, his research did not cover practicing teachers (presumably) but only those teachers who were currently in the MA program at Iowa State University.

Both Kessler and Plakans (2008) and Kessler (2010) seem to indicate that programs now need to consider the differences of technological knowledge for their teacher candidates in different ways. Whereas Egbert et al. (2002) showed that those teacher candidates who came in with less TPACK (i.e., using technology within their language classrooms) were less likely to teach with technology after a single class, both Kessler and Plakans (2008) and Kessler (2010) studied teachers or teacher candidates who had more (general) technological knowledge and were less able to integrate it in an effective way within classroom situations.

Kessler and Plakans (2008) also indicated that their study is limited in terms of the type of institution – the students came from a variety of situations, but a description of their particular institute of higher education was not mentioned. All of the institutions

studied in the research discussed herein are in the United States and, therefore, have a particular context. Institutions from other countries may have other foci, which would change the nature of the study. This indicates that further study of TELTE would be needed in institutions outside of the United States.

Furthermore, researchers also need to look more at training that happens in public schools. One issue that Egbert et al. (2002) had was in regards to which was more beneficial: training in the university, or training in practice within the institution where teachers work. While their study looked at teachers in practice, and some of them (11 of 26) were in the PK-12 setting, it did not really examine the effects of in-service training in that setting. The other research was either about teacher candidates in the classroom (Hegelheimer, 2006; Kessler, 2010; Koehler & Mishra, 2005) or teachers in practice in a university setting (Kessler & Plakans, 2008).

This review has discovered many gaps in the literature as indicated by the empirical research examined, including the need for studies about integrating CALL throughout the curriculum of a LTE program, how to encourage teachers to participate in integration of CALL, understanding how teacher candidates with high levels of TK can be taught to apply that understanding to TPACK, how to transfer classroom knowledge of TPACK into the classroom, how teachers are trained in practice, and how the context of schools affects the teaching situation. These gaps indicate a general need to understand the ideas of teachers and teacher candidates in different contexts and with different learning activities. Integrating TPACK and CALL would also provide interesting insights, allowing researchers to more clearly describe situations with terms used in the TPACK framework, such as understanding the differences between teachers with higher

TK unable to develop TPACK any faster than those with lower TK, while giving a more robust framework for study.

TELTE practice. It is also important to examine what the field has to say about the need for implementing TELTE in teacher training and what teacher educators need to accomplish. In order to examine this concept more closely, I will look at what research has to say about CALL training for teacher candidates in LTE education programs. Then I will look at the expectations of researchers in terms of the need for technological education of teacher educators in SLA.

Lack of CALL training for second language teachers. Starting back in 1997 and continuing for at least ten years, several authors have suggested that there is a challenge in terms of LTE and the integration of technology in teacher training (Butler-Pascoe, 1997; Hubbard, 2008; Kessler, 2006; Oxford & Jung, 2007). And while there has been less written about actual education programs explicitly since then, there is still concern about the need for instruction in using technology in ELT (Arnold & Ducate, 2015) as well as the role played by the textbooks in LTE, how they address technology, and what modifications may be needed to have the most benefit (Arnold, 2013). However, this review will discuss several factors which either have been or are prevalent in regards to TELTE.

Oxford and Jung (2007) report that students from primarily white and affluent neighborhoods have a better chance to access technology, especially in their homes. Those students who are minorities, in primarily minority communities, especially Hispanics and African Americans, are often challenged in their access to technology. Kelly (2007) supports this notion in a discussion of the development of two new kinds of

digital divide. In his terms, he suggests two further divides (other than just access to technology and infrastructure), which include:

(1) access to achievement enhancing technology mediated instruction (TMI)...; and (2) access to culturally sensitive TMI... [or] teachers [who are] knowledgeable about multicultural education, and able to incorporate this knowledge into their pedagogical practice of teaching with technology. (p. 33)

So, the digital divide he is referring to is not as much about minority access to technology, but how schools with high proportions of minorities use technology in their teaching.

Egbert and Yang (2004) also discuss the digital divide in terms of how technology is used. While in the United States there is a high percentage of schools which have access to technology and the Internet, the authors are concerned with how teachers are using it, and “how those who have it use it in the pursuit of effective language teaching and learning” (p. 281). They suggest that students should work with meaningful activities in the target language, use authentic tasks, view and produce language, have sufficient time and feedback, and engage in activities with a low affective filter and that support student autonomy. Warschauer, Knobel, and Stone (2004) were also concerned about the use of technology in the classroom, and found that schools with lower socioeconomic status focused more on using a device because they felt their students would not have access to technology at home. This research shows that there was a move from the access digital divide to a more purposeful use of technology divide (i.e., how are teachers using it) in the early to middle 2000s. Still, there are many articles that discuss the digital divide in terms of access to technology or access to the internet (Goertler,

Bollen, & Gaff Jr, 2012; Winke & Goertler, 2008), which has been the primary way this term has been used.

In a more recent discussion of technology use, Murray and Olcese (2011) categorized tools used with iPads in terms of five different categories and found the greatest use was for the “tutor” category (Means, 1994) which is the least “achievement enhancing” of the categories. There were fewer activities of the kind that are more appropriate for developing 21st century skills. There has been little research in terms of culturally appropriate activities available for students using technology.

Digital literacy, something which Oxford and Jung (2007) felt might be a challenge for some ELLs, has been suggested to be changing according to Gee (2005), Hayes and Gee (2010), and Prensky (2008). These authors suggest that being able to ‘program’ may become a new part of digital literacy skills in the future. Prensky (2008) specifically mentions programming as a new kind or level of literacy, where ‘literate’ people will be able to manipulate technology so that it performs functions that will be useful to them. Hayes and Gee (2010) discuss this in terms of modifying games (at least in the way they are played) to create situations which are more useful to learning.

The challenge with the need for culturally sensitive and other kinds of technologically mediated instruction means that you need teachers who are willing and able to teach using technology. Prensky (2008) is concerned about the lack of educators who understand programming well enough to teach it. Ertmer (1999) discusses teachers’ resistance to using technology as one of the biggest challenges of using it in the classroom. She has indicated, as I have already discussed, that one of the types of barriers to technology implementation were so called “second-order barriers” or

“intrinsic” barriers. These kinds of barriers are characterized by teachers’ perceptions of technology use and their beliefs about its usefulness.

In order for teachers to learn about how to use technology in the classroom, they have to overcome one of the biggest first-order barriers: access to technology training (Ertmer, 1999) in teacher education programs. Kessler (2006) did a study of how TESOL programs are preparing future practitioners in the TESOL field with CALL. He surveyed members of teaching listservs: “NetTeach, TESL_CALL, CALICO and LLTI”, all of which are for teachers who are interested in CALL (p. 28). He discovered that, “nearly 77% of respondents chose either somewhat ineffective (25%) or extremely ineffective (53%)” in their analysis of how their teacher education programs prepared them for working with technology (p. 32). Only 8% said their programs were “extremely effective” (p. 32). In listing the coursework available in their program, more than half of participants answered zero for the number of courses which “focused on technology” or had any technology training or teaching using technology (p. 33). However, between 40% and 50% responded “Always” and 40% to 50% also responded “Sometimes” to the following three questions: “Is the use of technology encouraged at your school? Does your school offer incentives for teachers who use technology for teaching? Does your school offer incentives for teachers who... develop technology for teaching?” Less than 10% replied with “Never” (p. 31). Since the survey was voluntary on technology listservs (in itself a technological device) their interest in the topic may have encouraged them to participate, which may have skewed the answers. Kessler (2006) further found that what these programs were missing are linkages with instructional use and the need to

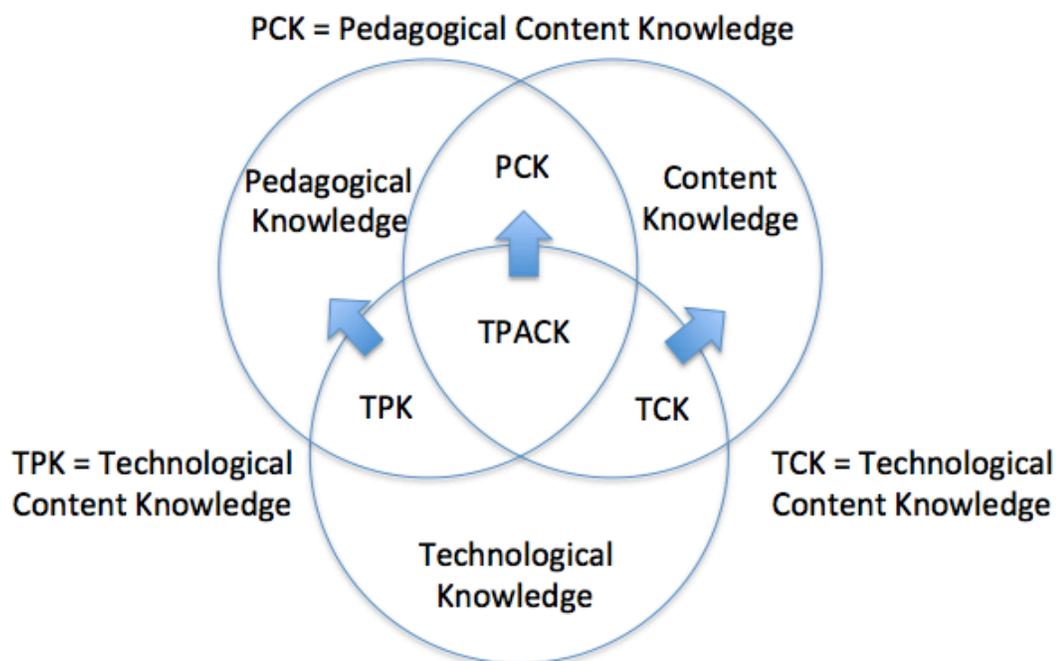
make tasks universal (i.e., not just something you can do on a course management system such as *Canvas*).

Similarly, several researchers (Butler-Pascoe, 1997; Hubbard, 2008; Oxford & Jung, 2007) have commented on the issue, noting that only slightly more than half of teacher education programs for TESOL offered any computer technology and less than 20% offered a course in CALL (Butler-Pascoe, 1997). While there may be some changes since Butler-Pascoe's research, Hubbard (2008, 2011) continues to express a need for teacher education program development. Kessler (2006) reported that in his dissertation he reviewed websites of 50 TESOL programs and found only eight mentioned CALL courses and only three had a requirement. These assessments, however, cannot discuss how incremental changes within programs – to use more online tools or hybridization of courses – have changed programs to become more technological. But as Zhao (2003) has stressed, programs need to consider not just technological needs, but also a “development of full curricula that are supported by available technology instead of individual tools that are only used infrequently or as a supplement to a primarily print-material-based curriculum” (p. 22). This suggests that educators need to do more than simply transfer a course from one medium to another. They need to consider the *implications* of the new medium of instruction and make attempts to use it fully. Also, Hubbard (2008) has pointed out that education programs need to do more than just incorporate the current technology into their teacher education practice; they need to prepare teachers for acquiring knowledge about new practices as they develop. Many authors (Butler-Pascoe, 1997; Hubbard, 2008; Kessler, 2006, 2007; Oxford & Jung, 2007) have been calling for

technological instruction for years. Hubbard (2008) has a plan which I will discuss in the next section.

Need to train for the next 40 years. One of the interesting things about working with technology is that it is constantly changing. The TPACK model used by Cox and Graham (2009) demonstrates this notion through the use of arrows which point from the areas where technological and pedagogical knowledge merge to form technological pedagogical knowledge, PCK to form TPACK, and content knowledge to form technological content knowledge while pointing back into the non technological knowledge infused areas they merged with (see Figure 2-7). These arrows in their Venn diagram represent how, when technological knowledge becomes more accepted, it would no longer be considered technological, but just a part of regular pedagogical knowledge, pedagogical content knowledge or content knowledge. Hubbard (2008) expands on this idea when he compares the relative ages of the teacher trainer and the teacher candidate, and the needs of the teacher candidate to be able to use the technology of the next 40 years.

Figure 2-7: Normalization of TPACK (Cox & Graham, 2009).



Hubbard (2008) wrote a theoretical discussion of CALL and language teacher training for the foreseeable future and suggests that when the training of a teacher candidate is complete, they will likely have a 40-year career ahead of them. Teacher trainers will likely have been working in the field for a while, and will continue to the end of their own 40-year career; this means they will be teaching teacher candidates to teach 80 years after having completed their own training. A teacher trainer starting in 2016 could be training candidates until 2056 who might still be teaching well into the 2090s. The potential for changes in technology over that time span is great. As Hubbard puts it, “[t]his figure undercuts any notion that somehow the goal of educators should be to ensure merely that students [teacher candidates] leave with an understanding of the current view of ‘best practices,’ be it with technology or otherwise” (p. 179). In contrast, Bax (2003) would have us work for a “normalization” of CALL, one in which CALL is not a separate field, and becomes embedded in the “normal” state of teacher education.

This notion presupposes no changes in the field of technology – or changes which would not require specialists to develop. Or, perhaps what Bax was thinking was that as we become aware of the inherent changes in technology, the idea of teaching teacher candidates for a changing world means to prepare them to constantly update their teaching practice as technology changes.

Kern (2006) also writes about the possibility that the need for CALL will disappear like it has for pen assisted language learning (i.e., using a pen and paper), but he leaves the discussion of his challenge to Bax. As Hubbard says

[w]hile it is appealing to both teachers and teacher educators to strive toward normalization..., [w]hat would happen to dedicated CALL, to software devoted specifically to language learning and teaching? Where would new breakthroughs come from?" (p. 180).

CALL, as a field of study, is necessary to train teacher candidates to be ready for technology integration and to prepare them with an appropriate level of TPACK to function in the classroom for all the reasons mentioned earlier. The need for CALL expertise, not only in teachers but also in teacher educators is important, because teacher educators need to know how to prepare our next generation of teachers – for the next 40 years.

Engeström (2009), through the use of his expansive theory and implementing technological learning systems to “improve” learning, discusses the contradictions inherent in an activity system. Because teachers, administrators and students all have different objections to the use of technology, there may be resistance to its use for the purposes intended. Often times, he notes, the context of the learning environment is

ignored when technological innovations – “new learning environments” – are implemented. The need for understanding the context is why he proposes his expansive learning cycle as a way of analyzing transformations within a system (i.e, changes to the culture of a closed environment like a school, workplace, etc.). As he says, “[t]eachers and other workplace practitioners are seldom as enthusiastic as the researcher expects, and all kinds of resistance arise when new learning environments are to be implemented in everyday use” (p. 25). Implementing innovations without the participation of key stakeholders (teachers, students and administrators) will not yield the anticipated results. Therefore, not only do teachers need to have a general understanding and appreciation of technological innovations and their purposes, but researchers and innovators also have to consider the needs and perspectives of teachers when implementing new programs.

Consequently, teachers as learners need to be taught not only about a particular software package, but general concepts and processes for learning about new technologies and applying them to instruction. In addition, Hubbard's (2008) theorizing, as well as other TELTE research previously cited (Egbert et al., 2002; Hegelheimer, 2006; Kessler, 2010; Kessler & Plakans, 2008) suggest that teacher candidates need to learn how to develop their ability to acquire technological skills while they are in training, so that when they go into the field they can continue to reflect and develop their skills further, as needed.

Teacher Expertise

While there has not been significant research in the LTE field on teacher expertise, in general, there is not much agreement in the area (Farrell, 2015). Still, because of the examination of the knowledge-base of LTE, it is important to have a brief

discussion of the idea of teacher expertise. The idea of expertise in teacher practice is a quality that is difficult to define and several authors (Farrell, 2013, 2015; Richards, 2010; Tsui, 2009b) caution against an easy definition, mainly because it is contextually and culturally based (Tsui, 2009b). Farrell (2015) cautions further that

there are no precise benchmarks of what constitutes effective second language teaching in all settings, nor are there agreed [upon] effective strategies that teachers should implement in their classes (not to mention what exactly effective teachers would look like in a classroom). (p 81)

Tsui (2009b) suggests several criteria which have been used to identify expert teachers: “number of years teaching..., recommendations from principals..., peers and students... and students’ achievement scores” (p. 191). Usually some combination of the above criteria will be used as an evaluation of teacher expertise. In both studies, Tsui (2009a, 2009b) discusses how expertise is more of a process than a state of mind, and other authors support this supposition (Farrell, 2013, 2015; Richards, 2010).

Tsui (2009b) goes on to describe the critiques of expert-novice comparisons which are more relevant to the idea of defining expertise as a state. She suggests that the idea that experts are more effortless in their teaching disregards the amount of work that experts put into teaching. In a comparison of writers, experts in writing were found to work harder, and Tsui (2009b) also discusses a similar comparison between novice and expert historians. The author’s suggestion, when transferred to the teaching field, is that because expert teachers have the ability to perform some functions more quickly, this allows them to “tackle more advanced problems and to problematize what appears to be unproblematic and routine” (p. 194, based on Bereiter and Scardamalia, 1993).

Comparing these expert teachers to experienced non-experts, the latter may use the same routines to become more efficient, but only solve problems “at a superficial level” (p. 194). Tsui (2009b) goes on to point out that experts have three further characteristics of continuous renewal of knowledge through praxis, “the capacity to transcend contextual constraints [and]... perceive pedagogical possibilities and exploit them for student learning” (p. 194) and the ability to use their mental resources to challenge themselves and develop their skills in new areas.

Classroom research on iPad use

This study looks at the frameworks defined by the literature in the first section of this review, but within the context of schools which have implemented a mandate of providing iPads for all students. iPads were developed and finally sold to customers in early 2010 (Mclester, 2012; Waters, 2010). There is a limited but growing research base regarding iPad use in the classroom and, more importantly, in the language learning classroom. Still, there have been concerns expressed about iPad use from teachers (c.f. Hall, 2015), who bemoan the idea that they started using iPads in their classroom in the first place. Still, not all research and analysis of the use of iPads is negative – much is positive. And there is some indication that students prefer using iPads (over other tablets and laptops, and even non-technological devices) when given the choice in language learning classrooms (Gabarre, Gabarre, Din, Shah, & Karim, 2014). Although there is some research on the effectiveness of iPads with comparable applications to non-technological interventions (Larabee et al., 2014), the research is still sparse and it does not focus on the effectiveness of iPads, but on how teachers use iPads to teach. Consequently, I will examine research in this section relative to school initiatives

regarding iPad use as well as any relevant classroom examples. While not a comprehensive examination of iPad use, it yields some insights helpful for my research.

School initiatives using iPads. Discussions about iPad use in schools should start with a discussion of its usefulness. In particular, one article (Murray & Olcese, 2011) has discussed the usefulness of utilizing an iPad as a teaching tool. In their discussion, the authors analyzed the hardware and software available for the original iPad not long after it came out. In these terms, they used four categories of technology created by Barbara Means (1994): technology which is “[u]sed as a tutor[,],... [u]sed to explore[,], [a]ppplied as a tool[,], and]... [u]sed to communicate” (p. 11). Murray and Olcese also added their own “21st century skill” category of collaboration.

In their evaluation, Murray and Olcese (2011) discovered that most of the “educational” software available for the iPad was in the tutor category (where the software basically teaches skills); about equally represented were the exploration category (users make some decisions about their learning) and tools (software not designed for education, but can be used to assist in learning activities like writing – word processors); there were fewer applications in the communication category (facilitates communication among students and between students and teachers); and finally the fewest applications of all (less than 10%) were considered by Murray and Olcese to be collaborative (allowing the opportunity for students to collaborate using the device within the application). Although they found the iPad promising, they suggested that it would not revolutionize education – because software was not being developed for this purpose.

The literature seems to indicate a disconnect between the hype and the actuality of iPad use. The hype is related to how some authors have suggested the media within the

iPad has been just repurposed for use on the device. For instance, Murray and Olcese (2011) mentioned that many of the applications used for exploration were simply a web page reorganized into an iPad application. They also mention that not many textbook companies have made iPad applications for their textbooks, but some publishers were looking into it in 2010 – although by 2012 Mclester (2012) noted that 30 textbooks in diverse fields had been developed for the iPad. While it is possible that these innovations will help revolutionize education, it is unlikely without a paradigm shift within the teaching field. Also, it is worth noting that most of the software available on the iPads has been available on computers and web pages for years.

Tablets, and especially iPads, do offer much in terms of potential benefits as a learning device. They have multitouch functionality (scrolling, pinch and zoom, etc.) (Mclester, 2012; Murray & Olcese, 2011); various kinds of networking abilities, including bluetooth, wifi and (sometimes) 3G; they have a very long battery life and they also have multimedia capabilities, including a microphone and speaker (Murray & Olcese, 2011). One of the biggest assets, may be their inability to support multiple applications in the same screen, which helps students to stay focused on their work (Mclester, 2012). Demski (2011) pointed out an additional benefit of iPads is that they were easy to learn how to use.

One of the interesting ideas that experts thought would happen, when the iPad first came out, is that it would start to replace older, keyboard-based technology (Waters, 2010). However, several authors (Daccord, 2012; Mclester, 2012; Waters, 2010) have found that iPads have not replaced older keyboard-based technology, but that they have been used to complement it. The differences between the devices is that keyboard-based

devices are used to create content, while consuming media is saved for iPads and other tablet-like devices. However, while mentioning this complementary relationship between keyboard devices and iPads, Waters goes on to discuss how netbooks and iPads do seem to be in competition: the existence of a one in a school usually precludes the existence of the other. (Netbooks are inexpensive laptops, sometimes with 3G connectivity, which have limited capabilities.) So, iPads seem at this point to be able to replace less expensive keyboard-based devices and vice versa.

The implementation that is becoming more common is a one-to-one implementation, meaning an iPad for every student in the class or school. Mclester (2012) stated he found one-to-one deployments in more than 1000 schools. This particular deployment is what this research examines, so the fact that it is common tells us of the potential for considerable concurrent research.

One-to-one implementations have benefits over shared computer use. Warschauer (2011) discusses the relative benefits and challenges associated with one-to-one implementations and computer access on a “shared or scheduled basis” (p. 31-32). He suggests that with a one-to-one implementation, the daily use of computers permits students to develop skills over time, which would mitigate the time spent learning how to use the hardware, which might take up too much of your time if you are only using computers relatively infrequently causing students to spend more time on technological tasks. Warschauer (2011) also points to the relatively cheap access to hardware and software which has been instrumental in making costly one-to-one implementations more practical. In this example he was referring to netbooks which were available for less than \$300 per student and “free and open source software” (p. 34) like Audacity, Hot Potatoes

and *Google Apps* (now *Drive*), just to name a few. Such hardware and software provides access to materials and software which students can use for the same purposes as those on more expensive laptops. This cheaper or often free software and hardware can also have unexpected benefits – for example, *Google Drive* not only provides relatively effective word processing software, but allows for relatively easy online collaboration between peers.

iPads and the iOS App Store are just another form of this movement, with slightly more expensive hardware and software that costs usually less than \$10 per user. Warschauer (2011) posits several strengths and weaknesses for iPads versus the netbooks previously discussed. On a positive side, iPads are smaller, lighter, more mobile, and instant-on; they have fast switching between applications, touchscreen interactivity and a flexible orientation which allows for book reading in portrait and video viewing in landscape layout. Among their disadvantages include their difficulty as writing tools due to the virtual keyboard, the difficulty to organize work because of an apparent lack of a file system as of the time of this writing, and the difficulty in accessing flash-based websites, which are still common. Finally an important disadvantage is their expensive price.

With implementation, Tom Daccord (2012) has pointed out that it is important to train teachers in the use of the iPads. Otherwise “iPads become expensive notebooks used by students in very traditionally structured stand-and-deliver classrooms” (p. 2). As Daccord states, the need to educate the teacher is a problem that has been pointed out many times before such as in the work by both Ertmer (1999) and McKenzie (2001) and Puckett (2013). The most important question for Daccord is: Why did you choose an

iPad? He suggests reasons to use an iPad in the classroom, but these reasons will not be consistent from context to context. Regardless of the reasons for choosing the device, they should be communicated clearly so that there will be buy-in from all the key stakeholders. The idea of communication of purpose is in line with the research conducted by Engeström (2009), as well as others (Ertmer, 1999; Larabee et al., 2014; McKenzie, 2001; Puckett, 2013).

There have been several studies on the use of iPads in the classroom. Larabee et al. (2014) did a study on the effectiveness of using an iPad in phonics instruction for first grade students. The study did not show if an iPad was more effective or not, because while the student performance was generally better using iPads for retention, this was not consistent across students, or even with the same students on different days. Without controlling for such factors as the amount of experience the students had with iPads prior to the study, their ability to use the iPad and the novelty (the ‘halo effect’) the results of the intervention cannot be determined. However, this does seem to agree with Zhao's (2003) determination that the more important factor is not whether a technological intervention is used, but the pedagogical design – that technological and non-technological interventions with the same pedagogical design should have similar effects.

More recently Gallagher et al. (2015) did an extensive two year study of iPad use in classrooms in three different classes in different international locations (Toronto, Sydney and San Diego). In each example, students from older elementary students to younger high school students were taught in classrooms with access to iPads. As they were in the process of observing and not suggesting teaching models, their findings showed varying activities and interactions with the students and iPads. There were no

conclusions about effectiveness, just some evidence that iPads can be used for activities from skills building, to production, to collaboration.

Classroom activities using iPads. Research (Demski, 2011; Saine, 2012; Waters, 2010) and practical reports (Al-Ali, 2015; Charles, 2014; Mallette & Barone, 2014; Noonoo, 2014) have shown that iPads can be useful tools for second language learners. In this section I will examine these articles which discuss the benefits of using iPads with language learners and some of the activities that have been found to be useful according to teachers and researchers.

Waters (2010) mentions use of iPads with “English as a New Language... students”, or English as a second language (ESL) students in a small school district. His research describes a pilot program in the summer that was a way for the school district to evaluate the iPad’s effectiveness. The technology director for the program felt that the iPad’s use would be good for ESL students because it is “easily customiz[able]... to the different languages our students come to [school]... with. And we can enable accessibility features that turn text to speech” (p. 3).

The use of iPads in the classroom is an innovation, as is the iPad is itself. Consequently, the data on its use, and kinds of uses, is very scant. However, there seems to be evidence that students find it engaging, either from the teacher’s perspective (Noonoo, 2014; Saine, 2012), from the coordinator’s view (Demski, 2011), or from a researcher’s observation (Al-Ali, 2015; Mallette & Barone, 2014). In the district where I am doing research, as well as at least in 1000 more places, administrators have taken a chance on giving all students an iPad to work with. The activities present in these classrooms may not be living up to the goals set by Murray and Olcese (2011), but

teachers and students are certainly using the devices for some kind of activity. It would be nice to know how teachers are using these devices. A recent *New York Times* article (Richtel, 2012) cited concerns by teachers about what the overabundance of technology is doing to students. Prensky (2001) suggested that students are different because of the generation that they grow up in Hubbard (2008), however, would suggest that these differences are more than simply generational, though generational differences should be expected. Expecting that students from the same generation are going to behave toward technology in the same way would be an oversimplification. Increasing use of technology at home and in classrooms may be having a profound effect on students' behavior. As one teacher put it in the *Times* article: “‘I’m an entertainer. I have to do a song and dance to capture their attention’” (p. 2).

Saine (2012) did a small study on how various teachers used technology in their classrooms. She allowed the various teachers to speak in their own voice. Demski (2011) discussed the use of the iPad, but also talked about iPod touches when she discussed ELL (English language learner) activities on iOS devices like the iPad. The main difference between the iPad and the iPod Touch is size – although older iPads also did not possess a camera. In most other aspects (including applications) they are very similar. Al-Ali (2015) discusses ways that iPads can be used for testing as a way of helping teachers who already have access to iPads and give them suggestions for how to improve their iPad use in the classroom. Of the four iPad applications she discusses, none of the capabilities noted here are special to the iPad. Noonoo (2014) presents information from various school situations as described by the teachers involved. The most interesting of these accounts is about ELL students in an elementary setting. The

teacher describes how students are able to use iPads to extend their language use within an activity. Their use of the iPads also made them leaders in their classes, because they could help other students use it later on. Mallette and Barone (2014) discuss various apps which can be used on the iPad to assist in the reading language arts classroom.

In terms of Means' (1994) and Murray and Olcese's (2011) categories of applications, and from the descriptions of various applications from the articles described above (Al-Ali, 2015; Charles, 2014; Demski, 2011; Mallette & Barone, 2014; Noonoo, 2014; Saine, 2012), there are more applications in the tool categories (15) (see Table 2-1), than any of the tutor (2), exploration (2), communication (6) or collaboration (2) categories.

Table 2-1: Table of Applications Based on Means' (1994) and Murray and Olcese's (2011) Categories.

	Application	Description	Reference
Tutor (Means, 1994)	<i>BrainPOP</i>	Used for initial information search, would be a tutor application, as it presented information.	(Saine, 2012)
	<i>Socrative</i>	An iOS application which also has a web companion, which allows for the creation of multiple choice questions.	(Al-Ali, 2015)
Explore (Means, 1994)	<i>Adobe Reader</i>	An application created by Adobe, which is available for most computing devices, which allows for reading and annotation of text.	(Al-Ali, 2015)
	<i>Safari</i>	Used as an application for research, exploring knowledge.	(Saine, 2012)
Tool (Means, 1994)	<i>Pages</i>	A writing application enabled students to produce documents; and separately, students used it write their own autobiographies.	(Saine, 2012) (Demski, 2011)

<i>Notes</i>	An Apple application, was demonstrated to for students to type in or make other physical annotations.	(Al-Ali, 2015)
<i>Strip Designer</i>	This application allowed the students to create cartoon strips with voice bubbles, so that the items in the picture could describe themselves.	(Saine, 2012)
<i>Evernote</i>	A ‘powerful’ note taking app which allows for multimedia and cross platform use which students could use to record their own voice reading the text they have written.	(Malette & Barone, 2014)
<i>Dragon Dictation</i>	Transcribes voice and converts it to text to allow for easier writing	(Malette & Barone, 2014)
<i>SoundNote</i>	Allows for taking notes either through the use of keyboard, or through finger scribble on the screen (handwritten).	(Malette & Barone, 2014)
<i>Voice Record Pro</i>	An application which allows for the recording of sound (e.g., voice).	(Al-Ali, 2015)
<i>Toontastic</i>	A digital story telling application used to create meaningful stories with graphics, using the elements designed in class.	(Saine, 2012)
<i>Explain Everything</i>	Students were able show their comprehension through drawing and then annotate the drawing with an audio description of what they have drawn.	(Noonoo, 2014)
<i>iPrompt</i>	Students used this like a tele-prompter to help with speaking or reading fluency.	(Malette & Barone, 2014)
<i>Writer’s Hat</i>	Used to come up with words, either through Wh- questions, or through parts of speech.	(Malette & Barone, 2014)

	<i>Vocabulary Spelling City</i>	Assist students' work on their vocabulary.	(Noonoo, 2014)
	<i>Word Bingo</i>	Assist students' work on their vocabulary.	(Noonoo, 2014)
	<i>Sight Words</i>	Assist students' work on their vocabulary.	(Noonoo, 2014)
	<i>Generic Applications</i>	There are some generic applications include translation, dictionaries and recording voice	(Demski, 2011)
Communicate (Means, 1994)	<i>iPod touch</i>	Used to record a student's voice and share with teacher.	(Demski, 2011)
	<i>iBooks library</i>	Students published their own autobiographies in each student's library for them to read.	(Demski, 2011)
	<i>Story Buddy</i>	The app helped students create eBooks and through that communicate their ideas.	(Mallette & Barone, 2014)
	<i>Story Wheel</i>	Used for the generation of stories which can then be narrated by the student(s) working with the app.	(Mallette & Barone, 2014)
	<i>Puppet Pals</i>	Allows for the creation of animated action associated with text/dialog, which can be used to communicate stories to others.	(Mallette & Barone, 2014)
	<i>iTranslate</i>	Used as an assistant for speaking another language, especially with second language learners.	(Mallette & Barone, 2014)
	Collaboration	<i>Google Docs</i>	Used in a collaborative document which was first brainstormed in one group, then outlined in another group, drafted in a third group and finally proofread by

yet another group.

Online Stickies

Allows for sharable notes for crowdsourcing, or networking ideas.

(Mallette & Barone, 2014)

There are a few examples from the exploration category, however much of the applications of earlier forms of CALL were based on tutor (or drill and skill). Because language production needs to happen outside tutor activities in order for it to become authentic, it is important that we have begun to move beyond such activities toward more production (through tools) and communication and collaboration. Still, the preponderance of tools and lack of ideas in the communication and collaboration area means that there is still too much focus on skills and not enough on productive language use.

One thing to note, many of the “communication” applications may seem more like tools, in terms of Means' (1994) category of applications. Sometimes these tools are being used for “communication” between students, by presenting something to be viewed, read or listened to for the purpose of communication. It is a tool, because it allows students to record their voice, words or videos. In addition, it is also indirectly used for communication because students can use these ‘recordings’ to interconnect directly with their teacher or other students. However, generally, communication applications are tools used to exchange messages directly.

Students are coming to the classroom with different experiences than the students of even a generation ago. These experiences give students the ability to do more with technology than their predecessors. To continue to motivate these students, activities

need to relate to the experiences of the students and use the skills that they have developed with technology.

Motivational aspects. Another aspect of iPad use, as has been specified in discussions of other aspects of technological innovations, is its motivational factor. The idea that a new technology can be motivational may have a relationship with the halo effect, first developed by Wells in 1907 – the idea that an item can be perceived in a positive way, because of an overwhelming positive aspect which hides the fact that much of the data supporting the positive perception may, in fact, be missing (Zha, Song, Xu, & Yang, 2013). However, the idea that a specific technology can be motivating has the potential for students to become more engaged in using the technology, and if the engagement and practice are effective, students may, in fact, learn more (Diemer et al., 2013; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006; Puckett, 2013). The effect of technology may be similar to engagement in reading which provides a similar reinforcement towards learning to read (Cummins, 2011). Several authors (Alhinty, 2015; Diemer et al., 2013; Flower, 2014; Larabee et al., 2014; Mango, 2015) discuss the motivational aspects of using the iPad in the classroom, and while one is inconclusive (Larabee et al., 2014), the others seem to indicate a more positive effect. Puckett (2013), in a review of literature on the topic, discusses many of the benefits which may be afforded through the use of ‘technology’ and its potential to address learning styles and therefore increase engagement and lower classroom disruptions, while also discussing challenges to address effective integration.

In this vein, Alhinty (2015) discusses how the iPads were used collaboratively with the students involved in his study and through this collaborative use, intrinsic

motivation was increased because students felt more connected to their peers through the use of iPads; this enforced the need to use the target language to communicate with their peers via the iPads (both inside and outside of school). Through the use of the multimedia aspects of the iPad, students were encouraged to use their devices to roam the building in search of realia to incorporate into their digital portfolios and then describe the pictures using the target language. Additionally, assistance with the use of the iPads was provided through discussion with the teacher and researcher in the target language, which relates to Gee (2004) and his notion of ‘just in time’ learning, or manuals provided by games as gamers need the information – that is in the context of the game situation for which the manual information is needed. Students are motivated to use and learn in the target language, because they want to be more effective in using the iPads. Many of the activities described as empowering or motivating on the iPad were related to software such as blogs or websites, which might be accessed by any number of devices – but the immediacy of the iPads, always on and easy to touch and go, make them much less difficult to use than more cumbersome laptops and/or netbooks.

Mango (2015) discusses the use of iPads for learning Arabic in college level language classes in the US. He used a survey of students to determine the level of engagement to and the usefulness of the iPads for learning that language. The students related both high levels of engagement using the iPads and a high level of belief that the iPads assisted in their learning of the language. There is no relationship between this survey data and any other data to support the perceptions of the students.

Flower (2014) studied the effect of time on task for three students with Individual Educational Plans (IEPs) which indicated challenges related to their on-task behaviors.

The students involved were enrolled in a special ‘residential’ school for students with more needs than could be serviced in a traditional school setting. The iPad was used in ‘game format’ with applications which included: “*Aesop’s Quest, K12 Timed Reading Practice, Question Builder, Quik Tap Words, Word Bingo, Word Magic...*, *Word Scramble...*[,] *Math Bingo, Math Evolve, Marble Math, and Math Ninja*” (p. 440). The applications provided immediate feedback on their answers and may have provided either a clue to the correct answer or the correct answer itself when the incorrect answer was given. Students were observed for their ‘typical’ behavior and their behavior during iPad sessions, during 10 second intervals, and the time on task behavior for the iPads was consistently near or above the 90% range for iPad use, while typical behavior was generally no higher than 50%, and sometimes much lower. ‘Typical’ behavior consisted of students independently completing worksheets, which the authors failed to note was a very different kind of activity than the iPad activities. This may also be consistent with Zhao's (2003) notion that technology is not a pedagogy, but a tool. The difference here is not as likely attributable to the effects of technology on the motivation of the students, so much as it is to the structure of the independent work, whether technological or non-technological. Games are a very different kind of activity than filling out the same kinds of answers on worksheets, and because of this, the study’s conclusions are suspect.

Many of the iPad initiatives which have been reviewed here provide some indication that iPads may be motivating in terms of participation in an educational task. While surveys from students are often used to indicate student motivation (Mango, 2015), one of the studies discussed herein was flawed because of dramatically different pedagogical activities on the two mediums (Flower, 2014) and another was not able to

discriminate between the two, perhaps because of very similar activities (Larabee et al., 2014), the notion that using a technological device, because it makes it easier for students to be engaged through the ease of creating or using ready made apps which support more pedagogically engaging activities, may have some merit. There is at least enough face validity of the iPad's efficacy to encourage many districts to purchase devices for their schools.

Summary

In this chapter I discussed three broad areas of interest related to my research. The first section discussed the two frameworks which informed my research, Freeman and Johnson's (1998) reconceptualization of the language teacher education (LTE) knowledge-base and Koehler and Mishra's (2005) technological pedagogical and content knowledge (TPACK) framework. The second section focused on how computer assisted language learning (CALL) research relates to my research focus. Finally, I discussed previous studies of iPads in the classroom in the language learning classroom.

The research base seems to indicate a need for teacher candidates to go through training in their teacher education programs which includes many different courses which have CALL or other forms of technological pedagogical and content knowledge embedded within them, because one course does not seem to be sufficient (Egbert et al., 2002). Even teacher candidates with high levels of technological knowledge will not have sufficient understanding of teaching with technology, so they will need to have a teacher program which has effective technological practices embedded within it, which would allow them to develop TPACK, i.e., strategic knowledge in terms of Shulman (1986), in how to employ technology in their classroom setting (Kessler, 2010; Kessler &

Plakans, 2008). Hubbard (2008), meanwhile, has suggested a need to develop a training plan for preparing teacher candidates for a 40-year career of ever changing technologically mediated methodologies. The abilities to adapt to a changing world has always been important for teachers – it is more important now with our new and changing world of technology. Researchers (Egbert et al., 2002; Hegelheimer & Fisher, 2006; Hubbard, 2008; Kessler, 2007; Kessler & Plakans, 2008) indicate a need to create a better understanding of the knowledge-base, and Hubbard would also suggest that research should be conducted to determine what form technologically enhanced second language teacher education takes, so that teachers are prepared for a 40-year career of ever changing technology.

iPads are a new innovation, which have been popular additions to schools – not as a replacement to other forms of keyboard-based technology, but as a supplement to it. While Murray and Olcese (2011) express doubt about its current usefulness as an innovation that helps to disrupt or change the classroom, they suggest that it has the potential to do so. Other research regarding the use of applications (Demski, 2011; Saine, 2012) seems to indicate activities which fall mostly in Means' (1994) categories of tools, with some evidence of these “tools” becoming somewhat communicative, although that is not their basic purpose. Beyond that, iPads have uses which administrators and others find useful, partly because of the attraction for students and their relative ease of use. Many of the features of iPads have been mentioned as useful, but one of the most interesting seemed to be one of its non-features, that of not allowing for more than one application visible at a time, which makes it easier for students to focus on their work. Because iPads are a recent innovation, it is important, as Daccord (2012) has mentioned,

for teachers to be trained in their use in the classroom – which is supported by previous research (Butler-Pascoe, 1997; Egbert et al., 2002; Ertmer, 1999; Hubbard, 2008; Robb, 2006). Because the schools I investigated were using iPads in a one-to-one implementation, I had access to a good source of information regarding a specific form of TPACK in classroom practice, one that is being implemented in schools nationwide. In the context of the research-base outlined above, next I will discuss my method and how it relates to the context of the study. In Chapter Three, I will review case study methodology and how it relates to my study.

3. Chapter Three: Methodology

The purpose of this study is to understand how teachers use iPads in language learning classrooms; identify how teachers' perceptions of teaching, technology, technology use, and students affect their use; and indicate what supports are needed for iPad use to be successful. The study examines these questions through the lens of technological pedagogical and content knowledge (TPACK) within domains of language teacher education's (LTE) knowledge-base. Specifically, it is concerned with how the elements of the TPACK framework, as designed by Mishra and Koehler (2006), interact with the three domains of the LTE framework: those of the teacher as learner, the activity of teaching, and learning and the context of school and schooling (Freeman & Johnson, 1998). This study was conducted within the context of a school-wide implementation of iPads for classroom teachers and students, examining how teachers' background knowledge, preparation (the teacher as learner), the rules and practices of the school (the context of schools and schooling) and the knowledge of students and their interactions with teacher activities (the activity of teaching and learning) may indicate a specific form of TPACK for using iPads in the second language classroom. Specifically, the study focuses on these questions:

1. How do teachers of language learners use iPads in their classrooms?
 - a. How do teachers' perceptions of teaching, technology, using technology and their students shape the way they use iPads with English language learners?
 - b. What supports facilitate the use of iPads for instructional purposes in second language classrooms?

This chapter contains an explanation of the rationale for the choice of the case study design for this particular research project. It includes a description of the methods for data collection and analysis and an examination of the case study's validity and reliability. Finally, the chapter examines the ethical considerations that underlie the study and drive the research expectations.

Rationale

According to Yin (2003), case study methodology is used when the study is either exploratory or descriptive, you have no control of behavioral events, and the phenomena you are studying are current. For Merriam (1998), case studies are not so much about the process, but the unit of analysis – the “case”. In this research study, the cases are teachers. I examine how teachers work within a new initiative in Rollings County (all names are pseudonyms), a one-to-one iPad implementation in each of the language classrooms that I am researching. According to several researchers (Duff, 2008; Stake, 1995; Yin, 2003), cases are bounded systems – that is, they are clearly defined in a place and a time. Case studies also rely on multiple sources of information which are developed in a rich context and rely on triangulation to bring the data together to a cohesive conclusion (Duff, 2008; Merriam, 1998c; Stake, 1995; Yin, 2003).

My study is a multiple case study of four middle-school ESOL teachers in two schools in Rollings County. It is bounded in terms of the data collection period, starting in the October of 2012 but primarily from January to May of 2013 and the number of observations (8 per subject) and interviews (10 per subject) (see below). It is also bounded in the sense that I only examine how each of these teachers uses iPads within the language classroom and how this is influenced by their perceptions. Activities which I

perceive have no bearing on this context, such as teachers taking attendance, are not considered as important avenues of research, and I do not pursue them either within the context of the interview, or observation, or within the data analysis that follows.

This study is a combination of relational and exploratory kinds of case study research (Duff, 2008; Merriam, 1998c; Yin, 2003). Exploratory case studies explore how and why questions (Duff, 2008; Merriam, 1998c; Yin, 2003), and relational case studies aspire to “go beyond pure description to find causal or relational patterns among observations or yield explanations about phenomena” (Duff, 2008, p. 101). This study examines the use of iPads in the language learning classroom through the lens of the three domains of knowledge as defined in Freeman and Johnson’s (1998) knowledge-base and the TPACK framework developed by Mishra and Koehler (2005, 2008). (See Appendix C.)

Because case studies are often used as exploratory research, and they have the ability to examine a particular bounded system from many different perspectives by the use of triangulation and in-depth analysis of data, it is a reasonable mode of study for questions regarding the experiences of second language teachers and their knowledge about technology use (Creswell, 2007; Duff, 2008; Merriam, 1998c; Yin, 2003). Several authors (Bax, 2003; Hubbard, 2008; Kessler, 2010) have examined the notion of using technology in second language teacher education (LTE) and suggested changes to improve the process, but to this point, few, if any, have looked at teachers based on their practical experiences as teachers, comparing them based on their age and potential for digital nativism (Prensky, 2001), experience as teachers, and experiences prior to becoming a teacher.

This study situates teachers within the categories of age, experience teaching, and experience with technology, and it uses both maximum variation and homogeneous sampling (see below; Patton, 1990b) to look for patterns in how teachers develop TPACK when using iPads in the LTE classroom. The choice of age is based on the idea of digital nativism (C. Jones, Ramanu, Cross, & Healing, 2010; Prensky, 2001) and experience with technology is based on several studies showing that teachers need to learn through experience (Egbert et al., 2002; Hegelheimer, 2006; Kessler & Plakans, 2008). The idea of experience teaching goes towards the idea of teaching expertise, and while not directly correlated with years teaching, teachers with more experience generally have the potential for greater expertise (Burns & Richards, 2009; Tsui, 2009a, 2009b).

Maximum variation is attempting to find extremes on one independent variable, and see if there are differences in the dependent variables. In this instance, the idea of maximum variation will assist in understanding the significance of variables like age and experience, through seeing how the oldest and most experienced teachers differ in their iPad use versus the younger less experienced teachers. The diversity of teacher technology use is predicated by Prensky's (2001) idea of digital nativism, and the idea of the teacher's birth year may have some indication on how they will use technology. Examining the extreme cases will give a robust analysis of differences.

Homogeneous sampling is used with a small sample of cases which share or are very similar on one independent variable, to see how this affects the dependent variables (Patton, 1990b). In this study the two homogeneous cases are similar in both their age and experience and, therefore may provide a stronger example for the ideal language technology teacher which, because the ideas of experience and digital nativism may

indicate opposite directions for ‘expertise’, the teachers are median in both categories. These teachers are both within the barest range of Prensky's (2001) digital nativism (C. Jones et al., 2010), as well as having some experience so that they should have at least some ability in teaching, although they may not exactly be experts (Farrell, 2013; Tsui, 2009b).

This study is an embedded case study design. It takes place within the context of a school mandated reform that places iPads into the hands of every student in every classroom. Within this broader context, it examines how the sociocultural context of two different schools influence this mandate, and how those different contexts affect the teacher as learner and teachers in the activity of teaching and learning. Similarly, based on the experience and age of the teachers, each classroom may provide unique insights into how differences in student experiences and teacher practice affect the development and implementation of teacher practice. It suggests how, with further research, teacher education programs might start to make changes in technological preparation within the context of the second language classroom so that future teachers can be prepared for the continuous changes in technology.

Type of Study

As an embedded multiple case study, my research design has multiple units of analysis within the school setting, but the focus is on the teacher within the sociocultural context of the school and schooling (Yin, 2003). The primary unit of analysis is each teacher who participates in the study and their activities in the classroom. The study will look at multiple cases of teachers in order to explore teachers’ activities in response to new technology initiatives and how they are influenced by the perceptions they have

gained through preparation to teach prior to working in the classroom, through the initiative, or by some other means.

The study will also be particularistic, descriptive, exploratory and heuristic (Merriam, 1998). It is particularistic because it focuses on specific phenomena (i.e., the integration of iPad use into classroom practice); it is descriptive because it will include rich descriptions of the school and classroom situations and each teacher's background – mostly from multiple perspectives; it is exploratory, in the sense that it is in search of unknown information, and does not propose a “fix” for the situation; and it is heuristic because it will shed light on these phenomena to confirm and/or develop further what is known about technological education, and more specifically, TPACK, CALL and LTE. The candidates will be selected through the use of purposeful sampling (Merriam, 1998; Patton, 1990), in which I will look to maximize variation and homogeneous grouping of teachers by age and experience (Patton, 1990b).

Context of the study. The context of the study is two middle schools in Rollings County Public Schools, a large suburban public school system in a mid-Atlantic state that has received iPads for all of their students. Both Maverick and Gran Torino middle schools (all names are pseudonyms) are Title I schools. Each of the schools is in the third year of the one-to-one iPad implementation. Each of the schools has approximately 60 students in its newcomer English Language Learner (ELL) population and was close to 70% Hispanic/Asian (although not all were ELLs, and only one of the schools provides services for ELLs who are not newcomers). The schools also have over 75% of the students with free and reduced meals.

In each school, there was more than one teacher of English for speakers of other languages (ESOL), (two for Maverick, four for Gran Torino). Consequently, a sufficiently large pool of candidates was provided from which to select. This pool of candidates allowed the selection of two extreme candidates (one young second year teacher, and one experienced older teacher with more than 15 years of experience) and two homogeneous candidates (both about the same age with only minor variations in their teaching experiences). The extreme categories were used in order to provide examples of the maximum variation possible in the dependent variables for the independent variables of age, experience and technology experience. The homogeneous subgroup was selected in order to form something of an ideal case (see below), where there were two teachers with a few years of experience teaching and a few years experience working with technology prior to teaching. My preference would have been to study classes where teachers primarily worked with language, but each of the potential case study teachers taught language in the context of another subject, and only three taught language in the context of a language arts class (see descriptions of subjects below). This was not my preferred situation because the teachers had a dual focus in their instruction and separation between the language and content of the class. I, therefore, focused on the goals of the class, and specifically those activities with a language focus to better understand the teachers' TPACK for LTE.

It seemed reasonable to presume at the time of my study that a teacher who had both some experience in teaching and some personal experience in using technology prior to becoming a teacher would provide an ideal case. The idea of the digital native (C. Jones et al., 2010; Prensky, 2001), would put birth dates around 1980 or later. With 18

years of K-12 schooling, four years of college and another two for a master's degree, a beginning teacher would be a minimum of 24 years old. Add ten years of experience, and the oldest digital native would be around 34 years of age in 2014 (the time of the study). Any teacher who had been teaching much longer than this would fall out of the ideal, digital native range.

The rationale for digital nativism—access to technology at a young age—makes the person (or in this case future teacher) more likely to use technology in their personal and professional life. At least two authors have pointed to 1980 as being a kind of time of transition for computer assisted language learning (CALL) (Bax, 2003; Warschauer & Healey, 1998). Warschauer and Healey (1998) describe a transition from “Structural” to “Communicative” CALL around 1980. Bax has a similar date for the transfer from “Restricted” to “Open” CALL. In both cases the authors anticipate or predict a change at the time of their writing (around 2000) to a new form of CALL; in Bax's case it becomes “Integrated”, for Warschauer and Healey “Integrative”. Regardless, while there currently is the possibility of a future teacher learning a language in a CALL classroom, there was not a discussion in any of these articles about how common it was for technology to be used in a language classroom, and other authors writing at around the same time, or later, discussed how little was being done to support teachers to use these types of CALL (Butler-Pascoe, 1997; Egbert et al., 2002; Kessler, 2006).

Nineteen eighty (1980) was also around the time that personal computers became more accessible to individuals, and by extension schools. Because of the increase in technology to purchase for classrooms, it became more probable that computers would be purchased for the classroom. And with the Macintosh and Windows (which came a few

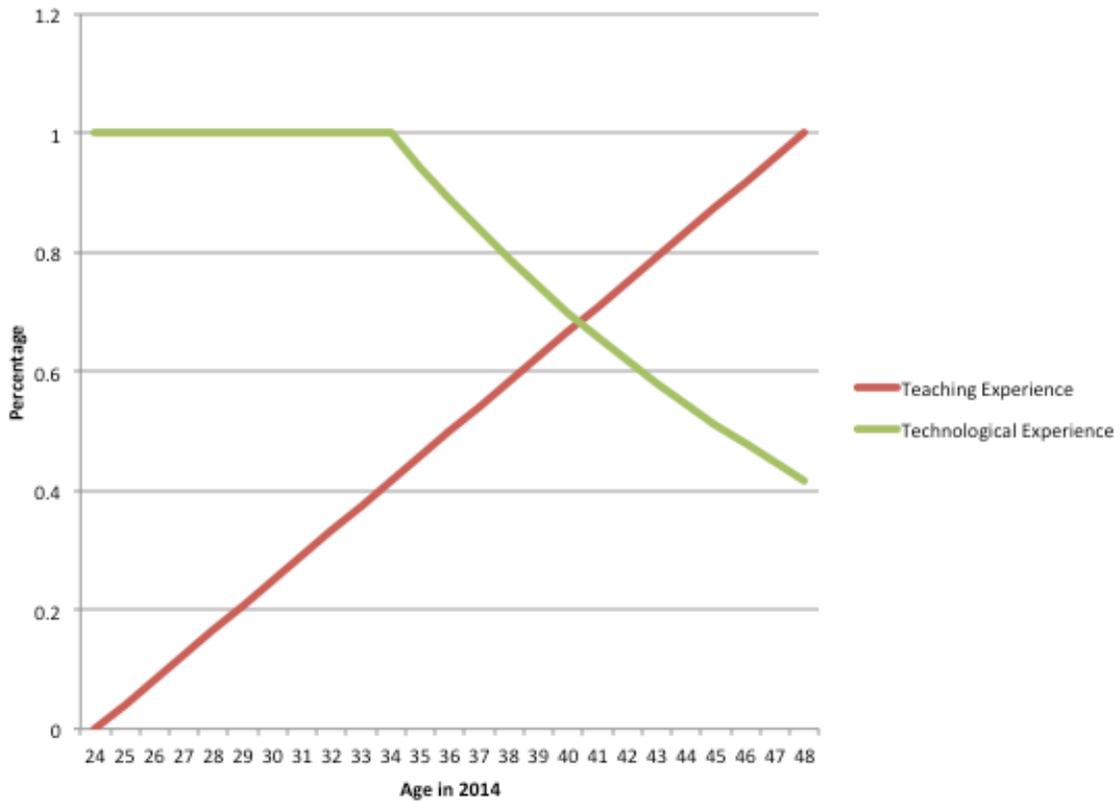
years later) and the WYSIWYG (What you see is what you get) graphical interface, it became much easier for people without programming experience to use computers.

It also seemed reasonable—at the time of my study—that someone who had limited experience with teaching would not be an ideal case, because they would have had less understanding of how to use technology in the classroom (either because they did not experience it as a student, or they had less expertise in using it as a teaching tool). Teachers of language seemed to be at a crossroads at this time, where teachers with a lot of experience teaching have a limited experience with technology, and those who grew up with technology, may not understand enough about teaching and teaching with technology to use it.

This idea is represented in Figure 3.1 (below) which shows the intersection of increasing teaching experience with decreasing technological experience at around 40 years old in 2014. Teaching experience is calculated by assigning a value of 0 to those teachers who are 24 years old and then adding a year of experience for each year of life over 24. I then made this a percentage of 24 years of experience, because technological experience was a percentage, and I chose to end the chart at 48 years old, someone with 24 years of teaching if they started at age 24. Technological experience is calculated as a percentage of double the number of years a teacher has lived prior to 1980 subtracted from a whole of 1. A “digital native” would be represented as a 1.0 value, and anything less would be a digital immigrant. Since Prensky (2001) made a rather hard break between digital natives and digital immigrants, it is hard to represent this graphically, but this is why I doubled the years prior to 1980, to make the break more dramatic. The chart

shows how using technology might be represented for the typical person who was alive in 2014.

Figure 3-1: Teaching Experience vs. Technological Experience



The reason I chose middle schools for this research is because the district had selected four middle schools for a one-to-one implementation of iPads, which were the only schools at that time with that level of iPads use (although there were other schools which had a smaller ratio of iPads to students), a matter of convenience sampling (Patton, 1990b). The implementation of iPads has given me an opportunity to study language teachers' use of iPads in a technology rich environment, which would make this a unique case sampling (Patton, 1990b). In addition, I have taught middle school students for

several years and have an insider perspective on the kinds of instructional demands that teachers face every day.

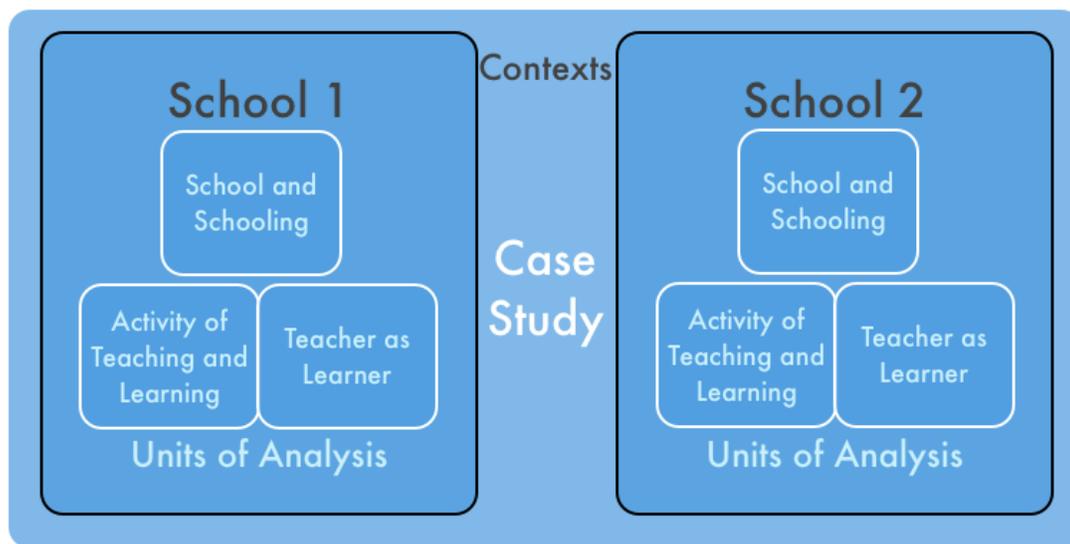
The choice the district made to put iPads in middle schools is fortunate, because there are many challenges associated with their students. Generally, students in middle school are at higher risk of dropping out; and the students have a significant drop in achievement for those who transition from elementary schools after grades 5 or 6 (Alspaugh, 1998). Additionally, English language learners experience challenges that include language development (Perie, Grigg, & Donahow, 2005); middle and high school-aged students are more likely to have gaps in their education when they come to school in the U.S. (Boyson & Short, 2003; Ruiz-de & Fix, 2000); they also have limited or no opportunity for development of literacy prior to entering secondary school, a skill which is important for content learning in the secondary setting (Short & Fitzsimmons, 2007).

iPads have the potential to assist with these challenges, because some of the studies mentioned that iPads may allow for more engagement in learning than other kinds of learning. More engagement may allow students to learn more (Diemer et al., 2013; Kuh et al., 2006; Puckett, 2013), which in turn could lead to students staying in school longer because of less frustration with lack of success (one risk factor for dropping out). Multimedia tools which are easily accessed on iPads may also make it easier to learn languages in the same way that realia and real experiences are used to engage language learners in language use (Alhinty, 2015). There are also many literacy-based applications (web-based and otherwise) which are just at the fingertips with an iPad.

These challenges may influence teacher perceptions of student needs in the classroom and how teachers may make adjustments to their technology use based on their perceptions of student needs. Because of these challenges, and their influence on teacher perceptions, how teachers use iPads in the classroom could, provide insights into language teacher identity and cognition.

Units of analysis. The different units of analysis within the study relate to the three domains set up by Freeman and Johnson (1998) (See Figure 3-2). The first unit of analysis is the school context and how the context of the school influences the teachers' use of iPads within that school. While the study considers this context as an important factor determining success or failure, it is not a primary focus. This unit of analysis can be described as “context of the school and schooling” in terms of the theoretical framework as defined previously in the literature review (Freeman & Johnson, 1998). The second unit of analysis is the classroom in which the teacher is embedded – the students, the teacher and the content area that is being taught, related to the activity of teaching and learning (Freeman & Johnson, 1998). This activity will be an important aspect of the study, as students and the classroom activities are important daily contributing factors to the use of any form of technology in the classroom; thus, the variety of classroom situations observed will be of some importance. The third unit of analysis is each teacher, which relates to the context of the teacher as learner (Freeman & Johnson, 1998). The teacher is another primary focus of the study, including previous experience with using technology, how training may help their use of technology, how they plan to use technology in their classes and which activities they actually develop for their classes.

Figure 3-2: Contexts and Units of Analysis.



Case Selection

This study has three different units of analysis, and each has different criteria for selection. The three different units of analysis (see Figure 3-5) are schools, classes and teachers.

School selection. The case study was conducted in two schools that have implemented iPads for all of their students: Gran Torino Middle School and Maverick Middle School. These two schools both have a one-to-one implementation of iPads in their schools. The use of iPads is considered a critical case sampling (Patton, 1990b) because it provides an intense situation wherein all teachers are required to use a new form of technology in their classes every day. Because the schools are the only two of the four in Rollings County Public Schools that consented to the study and have the iPads throughout the school day, the selection of these schools is also a convenience sample. As critical cases, these schools provide a school setting to study TPACK through their iPad implementation.

Class selection. Each class was selected based on purposeful sampling, in which the case selected was for the purpose of providing cases which are rich in data related to the central issues of the study (Patton, 1990b). That is, it is a class which has ESOL (English for speakers of other languages) instruction and where the teacher implements a technological innovation through the use of iPads. Both second language classes and ESOL classes focus on the learning of a new language. As a result, many similarities exist in these two types of classes. However, ESOL classes are different in that they are usually taught in the L2 of the student and may have the additional challenge of presenting more than the language, but also use the language as a medium of instruction for additional content (e.g., science or mathematics). Therefore, the classes are all ESOL classes, and the choice of excluding foreign language classes was to ensure some consistency between the cases.

Selecting teachers who are all working with newcomer students (defined in this district as the lowest language ability level, students who have just arrived in the country with little or no English language ability) provides yet another level of consistency for the subject selection. However, not all the teachers are teaching just ESOL: As mentioned above, ESOL teachers often use English as a medium of instruction for another content area. In this example, the teachers have multiple subjects (science, mathematics, language arts or social studies – see teacher selection below) which they teach through the use of English. Not any one teacher teaches the same content as any of the other case study participants. This variation will have an effect on the kinds of activities that the teachers use, as well as choices they make for supporting language development in their

classes. This variation will also make the cases less consistent in terms of the activities the teachers might attempt.

Teacher Selection. Since the focus of this study is on how teachers use iPads for language instruction, I selected a total of four teachers from the two schools who were part of the pool of second language instructors (specifically ESOL teachers working with newcomer students). When I initially investigated the schools' web pages, I considered a potential pool of eight teachers: five from Gran Torino (four in ESOL and one in foreign language) and three from Maverick (two in ESOL and one in foreign language). This number provided potential candidates in the situation where one of the teachers was unable or unwilling to complete the study.

Differences in technological pedagogical and content knowledge (TPACK) are indicated by different discipline area expertise (Mishra & Koehler, 2006) and so it is reasonable to study only teachers from a particular discipline (second language instruction). And while the field of CALL includes both language learning from within the dominant culture (i.e., ESOL) and language learning outside the dominant culture (i.e., foreign languages), for the purposes of this study, I chose to pursue candidates who were in TESOL to minimize areas which were not considered a part of the study (i.e., different languages).

When I met with the department chair at Gran Torino, he suggested two candidates who seemed like interesting cases to me: a teacher who was relatively new to teaching and iPads as an instructional tool, and one who was relatively new at using iPads for instruction, but was somewhat experienced. As Grand Torino was the first school from which I choose, and I knew I wanted a variety of teachers, I thought having one

who was new to iPads and one who was new to teaching, might provide good data sources. The department chair also offered himself as a potential candidate, but only in case someone was unable to complete the study. We both knew that one of the potential cases, Maggie, was working in a temporary classroom structure with minimal access to the Internet.

At Maverick, my choice was simpler as there were only two ESOL teachers at the school. Maverick had two teachers who were both experienced as teachers, and had been at the iPad school for more than two years. Since I was familiar with the school through personal information, I had previously contacted one of the ESOL teachers, Camilla, to encourage a connection with this school. My knowledge of the teachers—their ages and experiences with teaching and working with technology—indicated that these two teachers would balance the other teachers I had already selected from Gran Torino. I knew that these teachers had different levels of ability in using technology in the classroom, and that one was significantly older than the other three subjects.

One of the two teachers selected from Gran Torino provided a challenge regarding scheduling; however by the time I determined that her situation would make it impossible for her to provide a similar number of observations and interviews, it was already too late in the data collection period (April 2013) to replace her. At that point, although I did have the option of having at least one other teacher at the school, I felt the uniqueness of her case – as one of the two extreme cases with no other teachers available who fit this category – made it more beneficial to keep her in the study, rather than try to engage another teacher. She provided information of much interest from her experience

and technological savviness. In addition she was the only teacher in a temporary classroom (explained in more detail in the results section).

Of the teachers considered for selection, there was only one on each end of the maximum variation (Peter and Maggie), so I was fairly limited in my selection there. I could have chosen other teachers around Martina and Camilla's age and experience, but both teachers were willing to participate and seemed to be similar enough to provide some basis for analysis.

I selected teachers based on their age and experience, from different groups which I based on data used to create the chart above (see Figure 3-1) (Prensky, 2001): very experienced older teachers, experienced older teachers, experienced younger teachers, moderately experienced younger teachers and young, and inexperienced teachers. I chose to categorize within four broad ranges of experience for teachers: very experienced (more than 20 years); moderately experienced (between ten and 20 years); experienced (between five and ten years), and inexperienced (less than five years). In terms of age, I also chose three adjectives to compare the three different age groups: older (more than 40); younger (teachers in their 30s); and young (teachers in their 20s). Teachers in their 30s and 20s were more likely to be digital natives, while those 40 or older were much less likely to exhibit any of those qualities.

Teachers who fit three of these categories were available at the schools: moderately experienced older teachers, experienced younger teachers and young inexperienced teachers. The teachers of newcomer students at these schools allowed for one each in the extreme cases (moderately experienced older and young inexperienced teachers) for the maximum variation, and two in the middle category (younger

experienced teachers) for homogeneous grouping of a more ideal case (teachers who have experience with both teaching and technology – see Figure 3-1), allowing a larger sample in the homogeneous grouping than for each of the extreme cases, to gain a better depth of information through the grouping (Patton, 1990b). This provided two different types of selection criteria categories for data analysis.

Since I have previously worked as a mentor of teachers and acted as a supervisor of student interns in Rollings County, I am familiar with many of the teachers in the district. I already knew all four of the teachers who are the subjects of my study (see Table 3-1). I worked with two of them as a mentor teacher for their use of technology (Peter and Martina) and with one as a supervisor when she was in training (Maggie). I knew the fourth (Camilla) as a coworker of my wife. Of the four, the former intern is the one I probably knew the best, but each of these teachers had already formed an opinion of me in terms of my expertise on using computers and teaching. Their participation and responses to interview questions may have been influenced by what they believed they should say, rather than what was actually true to them (Ertmer et al., 2012). In this vein, Merriam (1998) discusses the inherent power relationships within the interviewing relationship, and how these are intertwined with race, gender and class relations, where there might be the perception of inequalities based on gender or race differences, and for that reason interviewees may feel somewhat intimidated because they feel the need to answer the question or perform in a certain way. She also mentions the insider-outsider status of the interviewer, and how a researcher's status affects his/her ability to gain the trust of the interviewee. Another potential area of intimidation would be immigrant status, and while Peter is a citizen, he was also an immigrant from Ghana.

Table 3-1: Teachers Selected for Case Study

Name	Age	Experience teaching	Experience with technology	Classes
Maggie (G.T.)	25-30	2 nd year	Digital native	ESOL Language Arts (Level 1) and ESOL Social Studies (Newcomer)
Martina (G.T.)	35-40	About 10 years	Digital native	ESOL Science and ESOL Language Arts (both Newcomer)
Camilla (Mav.)	35-40	About 10 years	Digital native ?	ESOL Science and ESOL Mathematics (both Newcomer)
Peter (Mav.)	> 50	About 15 years	Digital immigrant	ESOL Language Arts and ESOL Social Studies (Newcomer)

Key: *G.T.* = *Gran Torino*; *Mav.* = *Maverick*

In this sense, my position as a male of a moderate socio-economic status differentiates me from all potential interviewees, at least in terms of gender (three females and one male) and may affect the power dynamics of the interview/observation process. Because of my familiarity with the interviewees and the system, I might be considered as something of an insider; however, my distance from their situation makes me more of an outsider. Also, as a doctoral student, the teachers may have a perception of higher status for myself and someone who has more experience and/or knowledge in terms of teaching and use of technology; all of them have a master’s degree and all but Camilla seemed to look up to me in terms of my technological expertise. Also through previous relationships, either as a non-classroom-based teacher mentor or an intern supervisor, I have been in a position of perceived higher status for three of the teachers prior to the study. Although I did not assume to have this “higher” status, it is perhaps likely that teachers might perceive me to have it.

Merriam (1998) also suggests that it is important for there to be distance between the interviewee and interviewer, so that they are not so familiar with their research subjects that the researcher is unable to attain some perspective on the situation. While

my degree of separation is not overlarge, my separation from the classroom for many years does give me some distance. Finally, having worked in the school district as an educational technologist for many years, these teachers might have been looking to me for solutions to their problems. As a researcher, I was not, in this instance, coming to them with answers, but with questions. Since I wanted to understand the differences in how teachers reacted to a new initiative, I needed their input, and I hoped to provide them with insights through my study. Similar challenges were prevalent for other parts of the study, including the observation of the classroom activities. I hoped that through repeated visitation, both the teachers and the students would be comfortable with me being in the room.

Duff (2008) and others (Merriam, 1998c; Stake, 1995; Yin, 2003) have pointed out the need to understand the effect the researcher may have on the event that they are observing. As Duff puts it

[i]t is... important to consider what effect one's presence has on the unfolding interactions, if any, or whether by being there the very activities or behaviors of greatest interest to the researcher are altered in some way (consciously or not). (p. 138)

Again, familiarity with the research subjects may have influenced the teachers either by making them more amenable to do what they think I want them to do or (hopefully) making them more comfortable with my presence.

Participants

The principals were the first participants I chose to interview, as each principal provided insight into the rationale for how the school is run (although in the example of

Gran Torino, the principal chose to have surrogates directly provide information about the school). Each of the schools had scheduled training sessions as a part of the program to institute iPads. I discovered as a part of this preliminary research (and with discussions with teachers throughout the year) that although there were training programs, they were not being held consistently. Neither Maverick Middle School teacher attended trainings of any kind during the school year. One Gran Torino teacher was a new teacher and attended general training on iPads from Apple, which did not provide opportunity for observation – however this same new teacher managed to become a trainer for the school as a part of a professional learning community. Through access to the teacher, I was able to acquire the materials of instruction for her classes. The materials for the course provided some insights into changes in the use of iPads for instruction for the two teachers at Gran Torino.

As has already been noted, the main thrust of the study is to examine teachers' use of iPads in the ESOL classroom, through the lens of TPACK in LTE. The study examines four teachers, two each from the two schools in the study. Each teaches four classes (see Table 3-1). The two teachers at Maverick (Peter and Camilla) both taught two different types of classes with two cohorts of newcomer students. Peter taught language arts and social studies, while Camilla taught mathematics and science to the same two cohorts of students, so they each taught each class twice, sharing the same students. The two teachers at Gran Torino also taught two different types of classes: Maggie only taught social studies to the two cohorts of newcomer students which she shared with Martina and she also taught language arts to two cohorts of beginner (one level above newcomer) students. Martina taught two newcomer classes (science and

language arts) with the same newcomer student cohorts that Maggie worked with in her social studies class.

Data Collection

The data protocol relates the research questions to the data collection instruments in order to make the study more valid (Yin, 2003). Therefore, in this section, the data sources are linked to the research questions directly as shown in Table 3-2. Data sources include: principal interviews, principal documents, teacher interviews, teacher observations, and teacher documents. Interviews were audio recorded. Observations were recorded through the use of an observation protocol (see Appendix D).

Table 3-2: Matrix of Research Questions and Data Sources.

Question	Data Sources
Research Question 1: How do teachers of language learners use iPads in their classrooms?	Class observations Teacher interviews Teacher documents
Research Question 1a: How do teachers' perceptions of teaching, technology, using technology and their students shape the way they use iPads with English language learners?	Class Observations Teacher interviews Teacher documents
Research question 1b: What supports facilitate the use of iPads for instructional purposes in second language classrooms?	Class Observations Teacher interviews Principal Interviews Principal documents

The observation protocol was an instrument for recording activity in the classroom. The purpose of this was to record activities as they occurred and which were specifically related to the use of technology. Also, it was my intent to indicate the amount of time in which a specific activity took place, so I kept a running record of the time of the activity. The protocol was a table on which I recorded any of the following items that were relevant for a particular time point: Teacher action/words; student response (to teacher/device); device use/application; and initial analysis. The teacher action/words could include simple things like “the teacher displayed... on the iPad

through the use of a projector”, or a verbatim recording of the directions given for an activity. Student response might be something as simple as “student turned on iPad and started... application”. I recorded some transcription of student verbal responses (either to the teacher or the device), but mostly I recorded actions in relation to their use of the iPads, or response to directions pertaining to their use of iPads. Device use/application might be noted in relation to the teacher, the student, or both, describing iPad activities, or less often, referring to presentation activities by the teacher. Any initial analysis of the activity recorded either at the time, or during the observation period, was also indicated in the final column.

Data Collection timeline. The timeline for the data collection was as follows (see Table 3-3). First, I identified possible sites to participate in the study and contacted these sites for permission to collect data. Through the initial contact with the principal(s) and the school(s) I gained access to the classroom settings. Teachers were identified fairly early through meeting with principals and I quickly moved into collecting permission from parents and students to gain access to the classes, with the assistance of the teachers. In most instances, there were two classroom observations for each class taught by each teacher, followed by a post-observation interview. Each teacher and administrator had an initial interview and a final interview. All of the interviews were audio recorded using my laptop.

Table 3-3: Timeline of Data Collection (Merriam, 1998).

Participant	Beginning of the year	During the year	End of the year	After the school year.
Principal	Initial Interview		Final Interview & Member Check	Member check
Teacher		Initial Interview; Observations (2/class/teacher); Post observation interviews (1/observation); Document collection (continuous).	Final Interview & Member check	Member check

Principal. Information gained from the principals' interviews (Appendix E) was considered to be background information regarding the context of the school setting. Since the main focus of the study is to understand the use of iPads within the classroom, the principals mostly provided background information regarding the school context, the teachers and the classrooms. Issues discovered later in the classroom would be discussed in the closing interview. The principals were interviewed two times during the study. The first interview (Appendix E) with each principal was conducted at the beginning of the study for that school. The purpose of this interview was to gain access to the school, gain an understanding of the school's context and the principal's goals for the program and determine relative competence of the second language teachers in terms of their technological use.

The second interview (Appendix F) with each principal was conducted at the end of the school year, as a follow up to what happened. This interview was also a chance to member check the principal's participation in the study. Further member checking was done after the second interview to verify any changes made and to verify the additional information gathered as a result of the second interview. The interviews were conducted as semi-structured interviews, that is, there were guiding questions, (explained below; see Appendices E & F), but I allowed the interviewee to guide the direction of the process

beyond the basic themes that the questions represented (Merriam, 1998). Following the initial responses, I usually probed for further answers and reserved the option to ask follow-up questions at a later interview time, if necessary. Through this process, I hoped to gain the most meaningful insights by following the threads of evidence.

The interview questions started with general perceptions about the use of technology in the classroom, and iPads in particular. I also asked questions about the administrators' planning process to implement the use of iPads in their schools. I then asked them about their perceptions of different teachers, generally, to see who they thought were strong teachers using iPads, and who was struggling. Finally, I wanted to know about their plans for the current year of using iPads in the classroom. The final interview served as a reminder of the goals, and whether or not the administrator felt they had been accomplished. I also asked about teacher use; whether there would be changes in their plan for the following year and about the support received from the district or other sources. Finally, I asked if their perceptions of iPad use had changed, and if the teachers would change how they evaluated their use of iPads in coming years.

Teachers. Based on discussions with the principals and their surrogates, four teachers were recruited from each school to participate in the study. Each of these teachers was contacted and asked to participate in three kinds of interviews (initial, post observation and final), agreed to at least two observations for each class, and asked to share any documents relevant to the study. The initial interview (explained below; see Appendix G) occurred at the beginning of the study and was for the purposes of gaining background information regarding the teacher's education, attitudes toward technology, in general, and the iPad project, in particular. Part of the interview focused on how the

teacher plans a lesson using technology. For this purpose, the teacher also was asked to walk me through how he/she might plan a lesson using iPads. The teachers generally did a think aloud of the processes that he/she goes through when planning a lesson (McKay, 2008).

The initial interview had the following goals (see Appendix G for questions): to understand 1) the background that the teachers bring to the classroom – their experiences, their technological knowledge, and their education (Ertmer et al., 2012; Kim et al., 2013); 2) their general beliefs regarding pedagogical practices in the classroom (Ertmer, 2005; Ertmer et al., 2012); 3) their prior experiences with using technology in their teaching (pre-iPad) – for example, if they had modified activities similar to those for the classroom – their perspectives on using new technology, and their feelings about integrating technology into their future classroom activities (Ertmer, 1999); 4) how they plan for particular lessons using the available technology (talk with other teachers about activities that are available, search the Internet for resources, or evaluate iPad specific applications for their usability) (Pierce & Ball, 2009; Robb, 2006); and, 5) how they personally want to grow in terms of their iPad use (Niess, 2011).

Teacher observations were limited or selected ethnographic observations (Day, 1990). This means that I focused on a limited number of items while observing the classroom (the time of the activity, teacher action/words, student response, and/or device use/application). I looked for several items related to the use of technology (see Wallace, 2004 for questions 1-6): 1) how the goals of the assignment are related to the purpose for using the iPad; 2) how student activities are managed when they are working on iPads; 3) how the transition from non-iPad work to iPad work is handled; 4) how engaged the

students are in the iPad-based activities; 5) how the teacher interacts with the students while they are engaged in iPad-based tasks; 6) if and how the text/materials are modified for use with language learners (see Appendix D for observation protocol and above for an in-depth description).

The observations of classes helped to determine elements of teacher knowledge, how they use iPads in the classroom setting and their competence with using iPads in instruction. During the observations, I primarily focused on four of the observation items mentioned by Merriam (1998): participants, activities, conversations, and subtle factors (e.g., informal unplanned activities, symbolic or connotative meanings of words, nonverbal communication, etc.). The observation of the setting took place prior to the initial observation and/or throughout the observation period when the teacher was not teaching, or not using iPads and/or other technology while I was sitting in the same classroom. All observation protocol elements (teacher action/words, student response, iPad use) during the class were noted, and any initial analysis was also entered at the time of observation. Since I wanted to be less of a participant in this setting, I focused less on the final observation element mentioned by Merriam (that of participant), but any significant observed reaction to my being in the classroom was noted for later analysis.

After each observation, I interviewed (see Appendix H) the teacher regarding the observation itself. This interview was also a semi-structured interview (Merriam, 1998), where I asked questions about the observations and the choices the teacher made during instruction. The teacher was encouraged to take the conversation in any reasonable direction which might provide further information regarding his/her use of the technology in the classroom, and I prompted the instructor regarding interesting aspects of the lesson.

In some cases, further inquiries about classroom instruction were pursued after reflection during subsequent interviews or the final interview.

For individual observation interviews (see Appendix H for questions), the teachers were asked about: 1) what their general goals for the lesson were, what they planned to do with the students, how they planned to assess the materials, and why they thought iPads would be a useful component in their lesson (Harris & Hofer, 2011; Wallace, 2004); 2) whether the lesson came from a lesson/unit they had taught prior to working with iPads, or if these activities were created specifically because of their use with iPads (Wallace, 2004); 3) what their comfort level with using the iPads was, whether it had changed or not, and what they were doing to increase their level of comfort (Harris & Hofer, 2011); 4) what challenges they found in developing lessons for the iPad (Kim et al., 2013); 5) how they were proceeding in their personal growth in iPad use for instruction (Harris & Hofer, 2011; Niess, 2011); and, 6) how they felt they had been supported in any recent meetings and/or trainings in which they had participated (Ertmer, 1999, 2005; Ertmer et al., 2012).

Finally, at the end of study, I interviewed (see Appendix I) the teachers to evaluate their successes and failures in using the technology in the classroom. At this time, the teachers were also asked to do an initial member check (Merriam, 1998) regarding their participation in the study. A further member check was performed after the final interview based on new information and changes from the previous member check. Also much of the confirmation of participants' information was conducted using *Google Docs*. Each participant was given a transcript of the interview and relevant analysis of the discussion through document sharing. Follow up conversations with each

of the participants ensured that they had had a chance to examine the documents to their satisfaction.

Data Analysis

The data collected in this study is completely qualitative in nature. However, to gain some additional understanding of the kinds of activities that teachers perform, coding of the observations has been quantified (Onwuegbuzie & Teddlie, 2003). This means that data discussion and analysis will be mixed in nature. In terms of mixed methods, this study is a concurrent transformative design with a qualitative focus (Creswell, Plano Clark, Gutmann, & Hauson, 2002). The data collected (observations, interviews and documents) were collected concurrently. After data collection, interviews were transcribed using ExpressScribe a transcription software package which allows for the slowing of audio files while still keeping the spoken word understandable. Transcribed documents were then marked with time stamps and the name of the speaker to match up with the audio once it was imported into NVivo.

All documents, observation notes, transcriptions and audio files were imported into NVivo for coding. Coding categories were created based on the theoretical framework and categorized based on one of four different areas: teacher as learner, school and schooling, activity of teaching (see below and Table 3-4) (Freeman & Johnson, 1998), and TPACK (Koehler & Mishra, 2008). After coding, data was quantified (see quantitative analysis below). After all data was coded and quantified, the data was triangulated for data analysis, with the primary focus of the research and analysis being on the qualitative measures. Consequently, the discussion of the analysis

of data focuses primarily on the qualitative data analysis using the quantitative data to provide a broader picture.

Table 3-4: Examples of Data Coding

Category	Example
Teacher as learner	- Feelings about iPads - iPad benefits for students - Teacher self assessment
Context of school	- Access - Atmosphere - Peer support
Activity of teaching and learning	- Activities - Flipped classroom - Materials replacement
Technological knowledge/TPACK	- Software evaluation - Time

Quantitative Analysis. Since all data collected was initially qualitative in nature, some of the data were quantified in order to obtain more precise counts of different kinds of activities (Onwuegbuzie & Teddlie, 2003). After coding, activities coded in observation data were quantified to determine how student-centered activity was based on seven categories (see Appendix K): student activities (Barron & Goldman, 1994), student (activity) goals (Barron & Goldman, 1994), student autonomy (Bailey, 2006; Bray, Aoki, & Dlugosh, 2008), teacher role (Brown, 2007), teacher poses (e.g., questions, statements, problems) (Valli et al., 2004), teacher responses (i.e., what teachers say in response to student work, whether to the whole class or to individual students) (Richards & Rodgers, 2014), and if or how technology was used (Niess, 2008, 2011). In general, activities were classified as a period of time where the class was focused on one kind of activity. Examples of activities included giving directions, working independently on some activity (post directions), reviewing homework or classwork, etc. Every time there

was a change in the nature of the activity, it was determined to be a new activity. In general, a class would have several activities during the entire observation – although one class (Maggie’s) ended up with only one. I created a chart of activities (see Appendix K; also see examples Table 3-5 below) based on the abovementioned research (Bailey, 2006; Barron & Goldman, 1994; Bray et al., 2008; Brown, 2007; Niess, 2008, 2011; Richards & Rodgers, 2014) and a study by Niess and Gillow-Wiles (2013). Since the authors chose student-centered activities as a demarcation of higher levels of TPACK, I decided to quantify ideas of student-centered activities and I created a scale from one (very teacher-centered) to five (very student-centered), based on how the research above defined more and less student-centered activities in each of the categories.

After the activities for each teacher were coded and quantified, a descriptive analysis of the data was performed, based on each category of how student-centered each aspect of each activity was rated. Due to the nature of the data collection, very few instances of teacher responses were coded, so this data was deemed not to be of use in evaluation of the kinds of activities teachers were using. Teachers were then assigned an average of the student-centered nature of their classes overall, based on an average of the above scores. I then removed all activities which did not include technology and did a similar rating of teachers for all technological classroom activities. Finally, the data was analyzed based on the overall level of student-centered activities (from one to five), the percentage of activities which were either coded in each level of student-centered activities (more teacher-centered 1-3 or more student-centered 4 and 5). These data points were averaged and compared based on the numbers for each level of rating and

used as a basis of comparison to determine what kinds of differences there were between the teachers.

Table 3-5: Examples of Student-Centered Activities Ratings

Example	<i>Rosetta Stone</i>	Students working collaboratively to create a video
Student Activity	2 - it was an individual working skills and drills (Barron & Goldman, 1994)	5 - there were student/ student interaction in the L2 (Barron & Goldman, 1994)
Student Goals	1 - it was working on discrete facts (Barron & Goldman, 1994)	5 - the students were working on problem solving (Barron & Goldman, 1994)
Student Autonomy	4 - it was a self-directed independent activity (Bailey, 2006; Bray et al., 2008)	5 - the students were self-directed and assisting peers (Bailey, 2006; Bray et al., 2008)
Teacher Role	4 - the teacher would be a facilitator (Brown, 2007)	4 - teacher as a facilitator, or 5 - teacher as resource, depending on teacher actions (Brown, 2007)
Teacher Poses	2 – lower order thinking questions (i.e., skill and drill) (via the application) (Valli et al., 2004);	4 or 5 - evaluated based on the instance, but most likely rated as posing higher order thinking (4) or higher order problem solving (5) (Valli et al., 2004)
Teacher Responses	1 - explicit correction (via the application) (Richards & Rodgers, 2014);	4 or 5 - based on their interactions, but would be most likely in the recast (4) or clarification request (5) level (Richards & Rodgers, 2014)
Technology Use	1 - it was a tutor situation (Means, 1994; Murray & Olcese, 2011; Niess, 2008, 2011)	3 for production or 5 for collaborative problem solving (Means, 1994; Murray & Olcese, 2011; Niess, 2008, 2011), depending on how the devices were used.

For example, the scores of individual teachers might be rated in terms of their total score for all the activities rated (see Table 3-5 above for example activities), to give an overall student-centered activities rating from 1-5. Differences of multiple tenths of a point would be discussed as being potentially different in terms of the kinds of activities that teachers might choose to do. Also, counting the number of a particular type of activity rated either below or above a 3 is of interest, as a point of comparison, because

sometimes an average might not be as informative as the numbers of activities which were actually more student-centered. Teachers could potentially have fairly similar averages, but still have more student activities, or the goals of those activities in a higher rating category, which would show that the teacher is at least attempting to address the needs of the students in some way.

Qualitative Analysis. Data analysis started with the first interview with a principal and the creation of initial categories or themes based on what is interesting and important in the data relative to the research questions and the theoretical framework (Merriam, 1998). These categories were initially organized by the theoretical framework, with a focus on the teacher, the classroom, the school and the technological support. Examples of themes which were created included: teacher – philosophy, attitude toward technology/iPads, teaching goals, etc.; classroom – management of technology, iPad use, collaborative activity, etc.; school – peer support, professional development, school policy, etc.; and technology- specific application use, technology activity, etc. (see also Table 3-4 above).

With each addition of a piece of data, whether from an interview, observation, or document, new categories were developed which were subsumed under the four analytic categories: TPACK, teacher as learner, context of school, activity of teaching and learning (see above). Each new category was thus related back to the theoretical framework and the questions developed to guide the study. Within the research questions the categories were linked together so that all the relevant data were included, no two categories could contain the same data, the name of the category reasonably reflected the

information within the category and each category was comparable in terms of abstraction (Merriam, 1998).

After the collection and transcription of the interview data, all materials were imported into NVivo for coding. Coding was conducted based on the theoretical framework (see Appendix C) and the research questions. After coding of themes, data was examined to detect patterns using the constant comparison analysis (Glaser, 1993; Merriam, 1998c). As themes were generated, they were compared to each other to determine similarity or difference. For example several themes were created and eventually categorized into “Personal experience and background” (teacher as learner). Some of the initial themes were: feelings about iPads, iPad benefits for students, iPad comfort, (teaching) philosophy, study comments, tech frustration, etc. This analysis of themes was conducted along the lines of the basic comparison of maximum variation and homogeneous grouping (Patton, 1990b), although if other cross-case patterns arose, they were analyzed and discussed. Relevant similarities and differences in each of the areas are considered and dealt with in the final presentation.

Synthesis. Once the qualitative and quantitative analyses had been completed, themes from the qualitative data were matched with data from the quantitative data. The quantitative data provided additional information regarding the character of the teaching activities used by each of the teachers and demonstrated any visible differences between the groups. Since there were also qualitative analyses of the same coded data, the quantified coding provided a clearer visual representation of the data in the form of a graph (see Figures 4-1 through 4-4) which shows the number of activities rated at each level in each of the categories relative to each other.

Ethical Considerations

Ethical considerations included two potential areas of consideration: the treatment of subjects and the treatment of the data. In terms of subject treatment, I focused mostly on the idea of reciprocity as suggested by Lincoln (1997) in her discussion of quality interpretive research. In terms of the subjectivity of qualitative research, Merriam (1998) and (Lincoln, 1997), among others, have pointed out that qualitative research is by nature subjective and, therefore, it is important to define the researcher's positionality and take other precautions in terms of ensuring high quality research.

Treatment of Subjects. Merriam (1998) specifies that qualitative researchers have at least the same ethical concerns as do their counterparts in the quantitative realm – mostly because their research is directly related to the relationship that they develop with their research subjects. In terms of being ethical in qualitative case studies, it is important to have specific goals and purposes for the research – and that the research be

guided by these goals (Yin, 2003). For this reason, Merriam provides several examples of ethical practices in terms of qualitative methods.

The first of Merriam's (1998) ethical concerns has to do with interviewing. The researcher has to be considerate of both the person that they are interviewing, as well as the purpose for conducting the interview in the first place – to gather data. While (as Merriam points out) it is not their purpose to be psychoanalysts, researchers do need to be aware and considerate of the psychological implications and challenges associated with participation in the study. All efforts need to be made not only to protect the anonymity of the subject, but to reassure him/her that anonymity will be protected. Beyond that, the researcher needs to consider the potential pitfalls of the questions, which may put the interviewee in the very uncomfortable position of considering negative aspects of his/her own participation in the research and/or the place of work.

Sensitivity to these issues will go a long way toward getting the data that is needed from the participant, in an honest and straightforward way. As Merriam points out, the stance that the researcher takes, and the knowledge that she or he brings to the research situation, can help the participants deal with the situation that they find themselves in. She refers to this stance as the “researcher's stance” (Merriam, 1998, p. 214), which brings to mind Lincoln's (1997) discussions of quality in qualitative research. In response to challenges to the rigor of qualitative research, Lincoln (1997) came up with ten qualities to give more assurance (e.g., positionality, voice, reciprocity, etc.). My particular stance is that I believe in Lincoln's reciprocity. Reciprocity is where a researcher becomes so embedded in the research that a relationship is developed between researcher and participant based on trust, and as a part of this trust, an element of

sharing develops. Sharing is effective when the researcher listens to the participant in a non-judgmental way, and the participant is aware of the potential and/or actuality of the researcher helping to improve the situation being researched after the completion of the study.

Observation, as Merriam (1998) points out, can be another source of potential ethical pitfalls. Many events could happen during an observation session which could provide ethical problems for the researcher. These problems may include illegal activities such as child abuse or sexual assault, but may also be simply a different form of participatory observation. In my role as participant-observer, I tended toward the notion of observation and commenting later – especially in the interview sessions about classroom activities. However, I could perceive times when I might have become more involved with the participant especially during discussions of the use of technology. This participation might have involved situations where I was left as the only adult in the room, or where the participating teacher might have requested assistance for a particular reason. In either of these situations, it would have behooved me in creating a relationship with the research subject to have reciprocated and assisted by participating in some way. And while neither of these instances did occur, it is always important to be prepared for such an event.

Treatment of Data. The nature of qualitative research makes it difficult for researchers to be objective in their analysis and conclusions drawn from particular kinds of research (Lincoln, 1997; Merriam, 1998). Researchers are human and tend to make decisions based on their own personal biases, no matter how objective they are trying to be (Goetz & LeCompte, 1984). In order to minimize the effect of the subjective nature of

qualitative research, a researcher could specify their positionality and inherent biases (Goetz & LeCompte, 1984; Lincoln, 1997; Merriam, 1998); verify the data with other sources, including the subjects of the research themselves (Merriam, 1998; Yin, 2003); and make sure that the research is designed in a way to support the research questions. Yin suggests the researcher create a chain of evidence connecting the research questions through a protocol to the resulting report which is written, including many elements in between.

My positionality in this study has probably been determined merely by the choices made in the literature review and the choice of methodology. Still, it is important to note the sociocultural influences inherent in the acceptance of research which supports a dynamic educational environment, where all social aspects of the process of teaching students a second language are included. It is clear that Freeman and Johnson (1998, 2003) has had a significant influence on the development of the conceptual framework and propositions which guide the design of this study. However, my influences are also the case methodology research based on Shulman (1986) and the work of Mishra and Koehler (2006). The extensive use of Merriam (1998) indicates that I am expressing a pragmatic side of the epistemological spectrum, as she tends to draw from both more objective researchers as well as from more subjective perspectives and tries to combine together research elements which work well together. Lincoln's (1997) pragmatism has also provided considerable influence on me, especially through her definitions of high quality qualitative research.

Also, as an educational technologist, I think that the effectiveness of technology is expressed by both using it to assist in helping language learners to acquire a new

language (Zhao, 2003) and ensuring that there is a process to developing technology integration in language teacher education (Hubbard, 2008). As Zhao states, technology seems to be effective when it is well designed. He highlights, however, the need to develop technology-based curriculum to enhance its effectiveness. In this vein, Hubbard suggests the need to develop technology teacher training (e.g., providing teachers with multiple opportunities to use technology, give them a chance to reflect on its effectiveness, etc.) so that teachers are more adaptable to new innovations. Zhao also derides the lack of research in K-12 institutions, which this study hopes to remedy in part.

It is also important to consider the need to provide students from other cultures who may not have had the same opportunity to use technology or the chance to acquire more opportunities to practice its use, as noted by scholars like Oxford and Jung (2007) as well as Kelly (2007). Oxford and Jung suggest that students from some cultures do not have the same access to technology. Additionally Kelly suggests that access to higher-order technology activities may not be present in their classroom settings. Having discussed these potential areas of bias, I clearly understand the need to have a balanced view of technology use and, in previous work (Sharp, 2011), have indicated the necessity to examine the contradictions inherent in poorly planned technology lessons.

An important aspect of finding bias is checking with key stakeholders and peers. In this vein, I worked with a group of peers who share their work in order to evaluate their progress and ideas. While it is entirely possible that this group may have some similar biases, it is hoped that other readers of the research will assist in mitigating this bias further, including the dissertation committee and key stakeholders. Member checking is an important aspect of the research as well, as all key informants (especially

teachers) were provided with at least one chance, if not multiple opportunities to check not only what they said, but to discuss my interpretations. As Merriam (1998) suggests, and as related both to Lincoln's (1997) community as an arbiter of quality and providing voice to the research subjects, allowing subjects to voice concerns and comments on the meaning of the research being conducted is a good check on the removal of bias from any aspect of qualitative research.

Yin (2003) also suggests the need for a chain of evidence when pursuing qualitative research. The purpose of the chain of evidence is to directly link the data presented in the research study all the way back to the questions asked by the study. Through this whole process, the reliability of the study was increased through the interconnections with the database where the research data is stored, with information linking it to the time and place it was taken, the protocol for conducting the research and the research questions which had procedures designated for data collection in the protocol.

Summary

In an attempt to create a high quality case study, I have designed my case study in terms of Yin (2003) and his step-by-step procedures for case study development, except for the articulation of propositions. However, the study design has also been greatly influenced by the work of Merriam (1998) in terms of the practicality of design. Both Yin and Merriam state the need to have a study that is well thought out in advance of starting any of the data collection. Yin also stresses the need to create a data collection protocol, use a theoretical framework and link both the protocol and the framework with research questions which are aligned with the purpose of the study.

This multi-case study is composed of multiple units of analysis. The units of analysis are with the domains of Freeman and Johnson's (1998) knowledge-base, which roughly are the school, the classroom and the teacher. Within each of these units, there are multiple cases to examine – two schools, four classes per teacher and four teachers per school. These units of analyses were conducted in the context of Rollings County Public Schools, a large suburban school system in the mid Atlantic, where there are four schools which fit the selection criteria: a one-to-one deployment of iPads and second language instruction. Further case selection within these contexts included the selection of teachers who are of maximum variation in terms of their experience in teaching and using technology and teachers who are of a homogeneous subgroup of an ideal case where experience and educational technology use are both maximized as much as possible, and they are also teachers of ESOL.

The instruments included qualitative tools such as interviews with principals and teachers and observations of classroom activities. Relevant documents were collected from each group.

I conducted semi-structured interviews in a comprehensive way, as suggested by Merriam (1998). Observations were also based on procedures suggested by Merriam, which include four elements: participants, activities, conversations and subtle factors. The setting was observed prior to most observations, and any interactions with me were made note of, although these observations were mostly in my interactions with the teachers.

Data analysis consisted of quantitative and qualitative analyses. The quantitative was a descriptive analysis of the student-centered activities using a scale I developed

based on research in the field (see Appendix K). Qualitative analysis consisted of the forming of categories and themes, which were developed starting with the first collection of data, and were matched with questions and the case selections to help determine research results.

Finally, I examined potential ethical considerations, including the treatment of subjects, and my own subjectivity in the treatment of data. A review process with peers, subjects and the dissertation committee was designed to produce the most honest analysis of the data that is practical. Since this is a case study, the generalizability of the study can be applicable in terms of analytic generalization – which allows the reader to determine the applicability of generalization through the rich descriptions provided by the author (Firestone, 1993b). Using the understanding above of case study methodology, I will next discuss the results of the study in the next chapter. I will focus the results on the questions outlined and the sample categories as discussed above.

4. Chapter Four: Results

In this chapter I will discuss the data collected from each of the four different cases I observed over the year. This data, in the form of interviews, observations and documents will be related back to the main question and two separate sub questions upon which the study is based. There were two cases at each of the schools I monitored. At Grand Torino Middle School, two female teachers were a part of a team of at least four (ESL) teachers. These two teachers were Martina and Maggie. At Maverick Middle School I observed two teachers, a male and a female, who were the only two ESOL teachers working at the school.

The data will be broken down within each area by the questions from study. Each will examine how the different factors affect teachers' use iPads in the ESL classrooms.

1. How do teachers of language learners use iPads in their classrooms?
 - a. How do teachers' perceptions of teaching, technology, using technology, and their students shape the way they use iPads with English language learners?
 - b. What supports facilitate the use of iPads for instructional purposes in second language classrooms?

Initially I will start out with a brief examination of the kinds of activities language teachers use in the classrooms. Then I will examine different perspectives based on their varied perceptions in the four categories of teaching, technology, using technology, and their students. Finally, I will discuss the supports provided to the four subjects of the study: Martina, Maggie, Peter and Camilla.

Kinds of activities observed for each teacher

Each of the teachers used a variety of different activities in their classes. As I review the activities, I will look at them in two separate ways. First I will give a broad

overview with activities counted in certain categories, based on a rating of student-centered activities (see Appendix K). The choice of student-centered activities was used to help gain a measure of TPACK level, as there is not enough information to measure growth, based on the discussion of evaluating the level of TPACK presented by Niess and Gillow-Wiles (2013). And while my research does not actually measure the knowledge of the teacher, it categorizes the activities in a way which shows how each teacher is able to use technology in their classroom. This would provide at least a baseline level of knowledge of the teacher – a measurement of their comfort with using iPads.

These activities have been rated in the following categories: the activities students were assigned to do (student activities) (Barron & Goldman, 1994); the goals of the activities which students were assigned to do (student goals) (Barron & Goldman, 1994); the control which students were given to complete the goals, and the roles students played in these activities (student autonomy) (Bailey, 2006; Bray et al., 2008); the role the teacher played in the assigned activity (e.g., facilitator, guide, resource, controller, etc.) (Brown, 2007); the kinds of questions, statements and interactions the teacher had with the students (teacher poses) (Valli et al., 2004); the responses teachers make to student questions, statements or other activities (teacher responses) (Richards & Rodgers, 2014); and the way in which technology, especially iPads, is used in the classroom

Each of the activities is rated from more teacher-centered activities to more student-centered activities. Student-centered activity ratings were based on seven categories (see Appendix K): student activities (Barron & Goldman, 1994), student (activity) goals (Barron & Goldman, 1994), student autonomy (Bailey, 2006; Bray et al.,

2008), teacher role (Brown, 2007), teacher poses (e.g., questions, statements, problems) (Valli et al., 2004), teacher responses (i.e., what teachers say in response to student work, whether to the whole class or to individual students) (Richards & Rodgers, 2014), and if or how technology was used (Niess, 2008, 2011). In general, activities were classified as a period of time where the class was focused on one kind of activity (see Table 3-5 for specific examples and Chapter 3 for more descriptive detail and examples).

Based on the descriptions of these activities, I coded my classroom observation notes. I coded one activity at a time, that is, I coded not based on the time of the activity, but when activity changed. If there was only one activity during the entire class, then the entire class would have at most one code for each element. For the most part, I had sufficient information to code the goals of the activity, how students were participating in the activity, their level of autonomy, the kinds of poses (see above) the teacher was using, the role the teacher was taking, and the use of technology. Since I did not generally write down feedback the teacher was giving individual students, I was unable to code a sufficient number of these items to make it relevant to tabulate.

One limitation with the way that I coded the observations is that a long activity (which most student-centered activities would be) would only receive a single coding, whereas teacher-centered activities (typically shorter) would have the same single coding, and it typically takes several teacher-centered activities to develop a student-centered activity. So, during one class there could be several teacher-centered activities that took as long as a single student-centered activity.

After examining the overall ratings of each of the teachers' student-centered activities, I will discuss in some depth one particular lesson which is representative of

each teacher. This may give a better idea of how small differences in ratings have more meaning in terms of what the teachers are attempting.

Martina. Martina had four classes which consisted of two groups of students. She taught each group of students twice during her normal day (once each for science and language arts), although her schedule varied depending on whether it was an A day or a B day. The two groups were different levels of “newcomer” students, students who had just come to the country and had very limited English use.

Depending on where one draws the line, Martina could be considered a very old digital native. She was about to turn 35, which makes her birth year the end of 1978 or beginning of 1979, which is the very earliest designation of digital natives. Most researchers who discuss the term place the beginning somewhere in the first few years of the 1980s, but some go just before that into the late 1970s (C. Jones et al., 2010). As a digital native, we might expect differences in how she uses technology in the classroom; such differences would also be expected from someone who had experience at a young age using technology, regardless of their age.

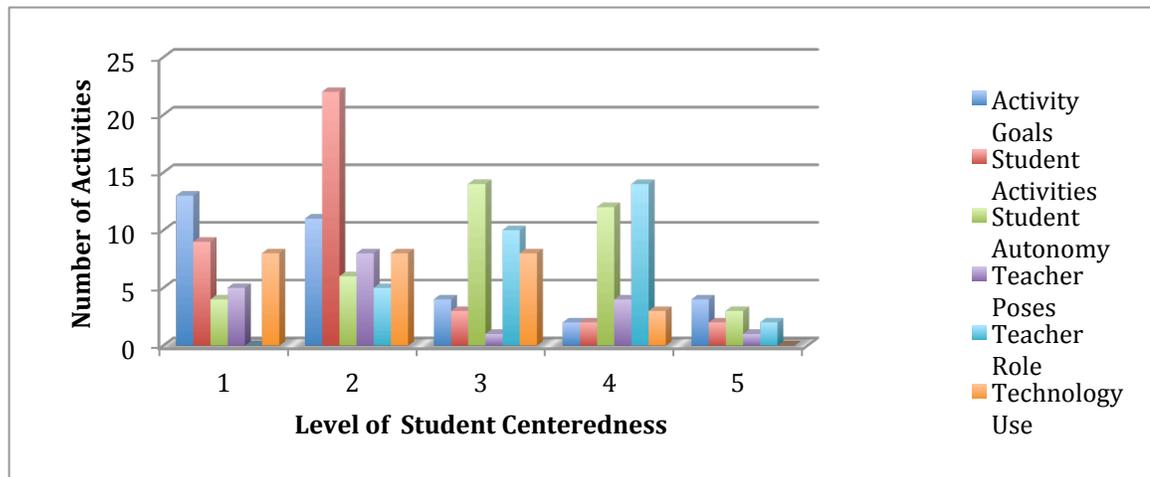
Overall activity ratings. The results of Martina’s activities are shown in Table 4-1 and Figure 4-1. On a 1-5 scale (see above), most of the activities Martina used in instruction were around 2 and a half, closer to the teacher-centered end of the scale than student-centered end. However, there were two notable exceptions: student autonomy (3.10 average) and teacher role (3.42). Martina has an overall average score of 2.59.

Table 4-1: Martina's Student-Centered Classroom Activities

	1*	2	3	4	5	Avg.
Activity Goals	13	11	4	2	4	2.21
Student Activities	9	22	3	2	5	2.11
Student Autonomy	4	6	14	12	3	3.10
Teacher Poses	5	8	1	4	1	2.37
Teacher Role	0	8	10	14	2	3.42
Technology Use	8	2	8	3	0	2.22
Total	39	60	40	37	12	2.59

* Goes from most teacher-centered (1) to most student-centered (5)

Figure 4-1: Martina's Student-Centered Classroom Activities



It might be more relevant to look at the numbers of higher level of student-centered activities Martina had in each class, because this would show how much she attempts to challenge her students with student-centered activities. In Martina's instance, she had 37 activities (2 in activity goals, 2 in student activities, 12 in student autonomy, 4 in teacher poses, 14 in teacher roles and 3 in technology use) which reached level 4 on the student-centered scale, and 12 which reached a level 5, or the highest student-centered activities rating (4 in activity goals, 2 in student activities, 3 in autonomy, 1 in teacher poses and 2 in teacher roles).

Additionally, Martina had the goal of developing student independence and specified that she spent a lot of time initially modeling an activity. This in turn, would create a lot of activities, activity goals and poses (questions or problems) which were more teacher-centered or controlled as she explicitly modeled what students should be doing. And while I did not observe this, if according to Martina's ideas and what she shared with me, she progressed from modeling, her students would be able to be more autonomous as they worked with the applications independently.

Of additional interest is technology use in and of itself – as this is another measure of the level of TPACK (Niess, 2011). Eight of Martina's classroom activities limited technology use to presentation activities only (using the LCD projector and/or playing videos on the iPad). Another two of the activities were independent activities – i.e., activities where the students were independently practicing skills (using tutor software). There were eight activities where students were independently working on language production or exploration (tool software). The final three activities had the students using iPads for problem solving. None of the activities involved any kind of collaboration between the students, which would be a student-centered goal of a language learning class.

Also interesting are the results when I controlled for activities where only technology is used (Table 4-2). There is a slight increase in the average of activities which are student-centered (from 2.59 to 2.62) for technology-based activities. The change is represented by the slight reduction of all activities and balanced by the kinds of activities removed being less student-centered. Because the activities using technology are at least very similar, if not a bit more student-centered than all of the activities

observed, it shows that (at least for Martina) her kinds of activities do not change much when you vary for technology, all other elements being equal. The activity reductions are mostly from the lowest three ratings (1: drops from 39 to 31; 2: drops from 60 to 46; 3: drops from 40 to 35). The biggest of these is the drop in level 2 activities, which probably accounts for most of the increase in average. The number of activities rated above a three also took a smaller drop than those lowest three ratings and with those rated 4 losing the most (from 37 to 28) and those which were rated a 5 only dropped by one activity (from 12 to 11). These changes represent how reducing activities has affected an upward change in average (though slight).

Table 4-2: Martina’s Student-Centered Activities with Technology Only

	1*	2	3	4	5	Avg.
Activity Goals	11	6	4	1	4	2.27
Student Activities	5	18	3	1	1	2.11
Student Autonomy	3	4	12	9	3	3.16
Teacher Poses	4	6	1	4	1	2.50
Teacher Roles	0	4	7	10	2	3.43
Technology Uses	8	8	8	3	0	2.22
Total	31	46	35	28	11	2.62

* Goes from most teacher-centered (1) to most student-centered (5)

In spite of her goals of producing independent students, the activities visible in her classroom were moderately teacher-centered. This may be because most of the activities were counted when she was modeling what she needed her students to learn.

One specific lesson. I was able to see many different activities during my observations of Martina. Some were specific to her science classes, while others were more language oriented. All had elements of language learning as a product of the class, but language was not the only goal of all her class. The activities I observed all had an

element of giving a demonstration, a model for her students to follow – even her post productive activities.

One specific example of an activity was her ‘lab report’ task. The students were engaged in an experiment for the entire class period but they were also supposed to write up a report on the experiment. Martina walked the students through the stages of writing up a report as she demonstrated this in front of the class. While this was probably not their first experiment, it was probably their first experiment using *Educreations Interactive* as a way of writing the lab report.

The lab report was supported through *Educreations Interactive* in the following ways: it provided an easy way to support the linear nature of the report with an easy display functionality; it provided a way of making the activity/ viewing of the report visually stimulating through the use of graphics and pictures of the event; and it allowed the students to record their voices over the text of the report after the fact. Since she spent much of the class in demonstration mode to guide them through the report generation process – waiting for students to complete that portion before going on to the next – this made for a fairly lengthy class project. As a result of this lesson, students would have been able to use the software to complete future lab reports more independently.

Some of the activities during this lesson were as follows: Martina started the demonstration lesson with the creation of her hypothesis page that she had chosen in *Educreations Interactive*, although she stated that students would do this for themselves in the future. One of the options the students was able to choose from the board for this was: ‘What happens when you mix vinegar and baking soda?’, which they agreed upon

for this demonstration activity. Martina encouraged students to take ownership as she demonstrated, when she asked what the “next step” was. She employed this strategy throughout – a kind of monologic discussion, with potential student interaction possible. As she was doing this, she demonstrated how to move the words around on the screen. She also had the students go and decorate their page, and demonstrated this by looking for question mark images on the web to add to her page.

This activity is rated as a four for student activity (teacher/student interaction); a three on student goals (comprehension and problem solving); a two on student autonomy (teacher directed with some autonomy); a three on teacher poses (presentation with some interaction); a two on teacher roles (director); and a three on technology use (production-based – used to explore and as a tool). Many of the activities in this process were similar. The student activity might have strayed into student/student interaction, but became individual production activities when they finished the activity; the student goals were mostly focused on comprehension and problem solving – usually related to creating the report and solving problems related to writing the lab report, not to analysis of what happened and why, although she did ask the question; student autonomy was mostly the same, although they did become self-directed/independent when they recorded the audio; the teacher roles were pretty much director throughout, although she became a resource at the end when students were recording; the teacher poses were mostly presentation with interaction throughout, although she posed (but did not expect answers to) higher order thinking questions at the end; technology use was the same throughout.

Martina had a level of student-centeredness of 2.59/2.62 (combined/only with technology). Though, despite the middle of the range numbers, she had scores which

were in both the teacher-centered range (1-2) and the student-centered range (4-5). Her sample activity showed that she spent a lot of time integrating technology into the lesson, but that the level of integration required students to practice only with a particular application with heavily scripted activities; in spite of this heavily scripted lesson there was an element of student independence when they recorded the activity at the end of the lesson.

Martina had a moderate score on her student-centeredness score, with an overall average of 2.59. She used many teacher-centered activities, some to initiate her more student-centered activities. Many times she seemed to want me to see how she demonstrated activities to students, though I did get to see several activities where the students seemed more comfortable with the activities. She had some creative ideas which she was able to work into the class, although some of her activities may have exhibited more of a language form focus.

Maggie. Maggie taught social studies to the same two groups of newcomer students to whom Martina taught English and science. She, however, also had two beginner level (slightly more English use than newcomer) ESOL groups: one each for 7th and 8th grade. Maggie is the only teacher who was definitely born in the “digital native” generation. If one believes that people born from since 1990 have special digital skills just from having lived through this time, then she should possess those different skills (C. Jones et al., 2010). Among the teachers in the study, she had the least teaching experience. At the time of the study, she was just starting her second year of teaching.

Overall activity ratings. Maggie had some of the highest ratings compared to the other three teachers on her classroom-based student-centered activities. However, there

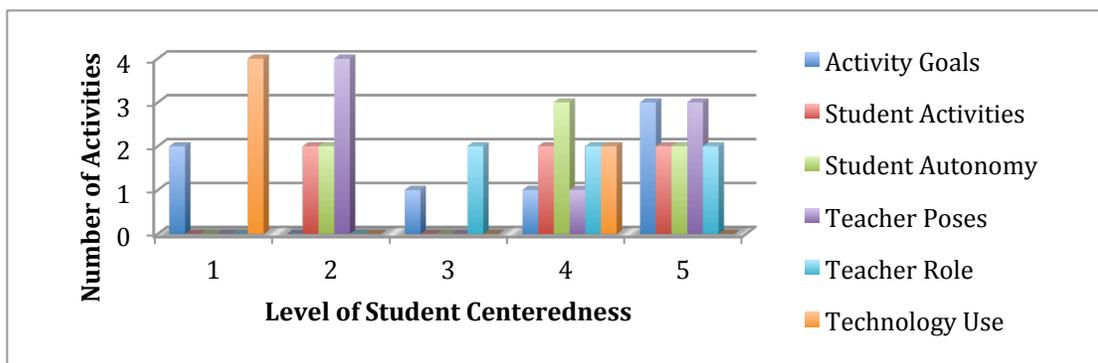
were only three classroom observations, each of which had large portions of class taken up with long student-centered activities. That left only about 7 activities total (see Table 4-3 and Figure 4-2). Her scores were all in the high 3's or 4's except for her technology use, which was only a 2. In terms of the number of activities in the student-centered range of 4 or 5, she had a total of 23 across all 6 areas (out of a total of 40). Maggie has an overall average score of 3.38.

Table 4-3: Maggie's Student-Centered Classroom Activities

	1*	2	3	4	5	Avg.
Activity Goals	2	0	1	1	3	3.43
Student Activities	0	2	0	2	2	3.67
Student Autonomy	0	2	0	3	2	3.71
Teacher Poses	0	4	0	1	3	3.38
Teacher Role	0	0	2	2	2	4.00
Technology Use	4	0	0	2	0	2.00
Total:	6	8	3	11	12	3.38

* Goes from most teacher-centered (1) to most student-centered (5)

Figure 4-2: Maggie's Student-Centered Classroom Activities



Of interest, for the purpose of this study, was Maggie's technology use. In four of the activities I observed there was no technology. In fact, for two of the classes I felt there was a distinct possibility of not having any iPad use (during one class, she had students go get the iPads well into the actual class – though that may have been normal because students would always have to get the iPads after arriving in class). She of

course knew that I was there to observe iPad use, and in most cases it seemed like she had something in mind, which might occur during the class. In addition, it is important to note that during all the observations, the students were able to make suggestions for iPad use (using iPads to record the script in the second observation and using one iPad each for recording, teleprompting, and keeping track of time in the third observation).

I believe that Maggie's challenge with using technology may have discouraged more opportunities for me to visit. This challenge with using technology is emphasized by the fact that she did not seem to have plans for using technology on two occasions when I did visit. However, her final observation she planned the class to be in a room inside the building, and the students were there only to complete their iPad project – the whole class was one technological activity. In this class (as in the previous observation when students were writing scripts) the students were working collaboratively on the iPads. For her limited use of the iPads, she had very high expectations of the students' use of technology when she did use them.

Comparing Maggie's activities with technology to the overall number of activities (only three activities, so a very small sample), the overall average student-centeredness of activities rose dramatically from 3.38 to 4.25 (see Table 4-4). As with Martina, this mostly represents a dramatic reduction of teacher-centered activities (1: from 6 to 1; 2: from 8 to 2; 3: from 3 to 0; 4 from 11 to 5) with this time no drop in the highest level of student-centered activity (5: unchanged at 12).

Table 4-4: Maggie’s Student-Centered Activities with Technology Only

	1*	2	3	4	5	Avg.
Activity Goals	0	0	0	0	3	5.00
Student Activities	0	1	0	0	2	4.00
Student Autonomy	0	0	0	2	2	4.50
Teacher Poses	0	1	0	0	3	4.25
Teacher Roles	0	0	0	1	2	4.67
Technology Use	1	0	0	2	0	3.00
Total	1	2	0	5	12	4.25

* Goes from most teacher-centered (1) to most student-centered (5)

Especially in the last class in one activity, Maggie showed her ideal of limiting teacher talk and engaging students in the activity of learning. This ideal is also evident in her other classes, as her students worked independently, productively and collaboratively for significant periods of time and with limited opportunities for teacher talk.

During the first observation, the students were using the Internet for a research project, and a lot of students were trying to access the weak signaled Internet all at once. Several of the students were compounding the issue by trying to listen to audio, or listen to *YouTube* videos. During another class, when students were collaboratively writing a script, one student chose to do ‘homework’ on her computer, by accessing *Achieve3000* during the class, and despite repeated requests to stop, the student continued with this until the end of class. Each instance indicated a challenge with managing the students while they were using technology.

One specific lesson. Maggie’s activities were generally lengthy, since all of the classes I observed were either project-based or research-based activities. In the initial class, she began with some classroom activities, and then led her students onto a “research” project activity, where they had some resources and were given the opportunity to find out specific information related to the topic they were studying. Each

of the other two classes I observed were two parts of a long term product-based activity, where the goal was for the students to create a video project describing some kind of mythical creature.

For the purposes of describing her activities, I chose to describe her initial preparation for an “interview” her students were creating about the creature “discovered” for their project. They were in the beginning stages of creating the interview video they filmed in the final class I observed. The goal of this day was to create the script. She also felt that they would possibly have had time to record the activity (on their iPads) as well,

I planned to cover the elements of drama and then for them to write their interviews and begin practicing their interviews. And then I had thought maybe we would begin to film, but I was pretty sure that was not going to happen, because of time. (Post observation interview, 4/9/2013)

And she was correct. They really did not get much of a chance to practice their interviews. This was the first class of the day, and her students ate breakfast in the class. They also had to get their iPads from another location within the building. After these activities, she began the lesson with a review of the elements of drama.

First, she asked students what an interview is and got a response. This seemed to be a review question. After this, she had them paste a printed document with elements of drama in their notebook. They then reviewed these elements aloud. The elements included words like “drama, actors, tragedy, comedy, etc.”. She read the definitions and made an attempt to assess their understanding. She had students circle parts of words (like “un” in unhappy, pointing out that it means the opposite or “not” happy). Then she

asked questions where students were expected to apply the words, for example, “If you have a TV show that makes you laugh, is that a tragedy or comedy?”, which the students were able to answer with some assistance.

They had been on a field trip the previous day to another school and were asked to discuss the “setting” of the field trip. There was some confusion in the answers about whether they were talking about a place or a person, but when prompted, they were able to answer questions about the field trip. She continued this review of terms, through a discussion of a script they had read before, highlighting examples which would be useful for their writing that day.

In this first activity she spent a lot of time trying to get her students to demonstrate their knowledge. For this reason, this was a student-teacher interaction in terms of student activities (a four). She asked a mixture of single word, yes/no and more complex questions, leading me to believe that this was more than a comprehension activity, but also one where she wanted to apply the vocabulary to a new situation, or a three in student goals, with comprehension and some problem solving. In terms of student autonomy, this activity was only a two, as she was clearly guiding the direction of the discussion, but also allowed for student input in terms of responses (teacher directed with some autonomy). In terms of the role of the teacher, she was a task manager, as she was managing the task, keeping the goal in mind, giving the students the opportunity to contribute to the overall body of knowledge (three). However, while she strayed towards more student-centered questions at times, in terms of higher order thinking questions, when students failed to respond, or responded incorrectly, she reverted to the more comfortable model of (perhaps for her, perhaps for her students) yes/no questions. Her

attempts at using higher order thinking and reversion to yes/no questions makes me think that her poses were more in line with lower order thinking questions. This particular series of exchanges did provide me with the rare chance to comment on her feedback, which was all content-based not language-based (the content being the vocabulary of a script). Most every time a student uttered an incorrect answer, she indicated that it was incorrect by questioning the answer (not saying explicitly that it was wrong, but asking if they were sure). Her questioning was in line with a kind of metalinguistic feedback, where the teacher highlights the error without explicitly correcting it. However, because she was only highlighting errors, I inferred the students usually had a clear idea that their answer was incorrect, perhaps even what the correct answer was. Thus this activity earned a two for feedback. Her only use of technology during this activity was to present information on a screen by means of an overhead projector. This rated only a one for technology use.

After the initial activity, she said she was going to give them “three minutes” according to my notes to practice their scripts prior to recording outside. She also mentioned beforehand that they had to write their scripts first, before they could record them on the iPads. She gave some clarifying directions including the number of sentences (ten) and the number of characters (three) in the script. She then let them work independently.

It might have been a very boring lesson for me to observe in terms of iPads, if one of the students had not suggested writing the script it on their iPad. She dithered, but eventually agreed, stating that they could use another iPad to record. For the next thirty-three minutes the students worked in groups planning and writing out their script.

Maggie walked around from group to group commenting on their task. At one point she noticed that “bigfoot” was a character in one of the interviews, and stated that was “awesome” (rather than just an interview of someone who had seen bigfoot).

Throughout, multiple students were typing on iPads; this was explained by Maggie’s insistence that each person had to have the script on their own iPad, so that they did not have to pass the iPad around. I only noticed one student not on task, and she was working on a task on *Achieve3000*, a literacy application. Maggie later compared this to doing homework for English class in the middle of mathematics class. She appreciated the fact that the student was working on her English, but was annoyed that she was not contributing to her group. At the end of this activity, each group presented a brief snippet of their script to the whole class.

This activity would count as a five on the student activities scale, as it was completely student-to-student interaction. It would also count as a five on student goals, as the students were problem solving and creating a product. While I did not see any overt instances of students helping each other, they were working together to create a product, so they probably were helping each other in some fashion. The student who came up with the idea of writing on the iPad was certainly helping the class. Either way, it was either a four for self-directed independent activity, or a five for self-directed independent task, helping peers in terms of student autonomy. Since Maggie was still providing suggestions, and not just answering questions, I would rate her teacher role as that of a facilitator (four). While there were not explicit poses throughout, the whole activity would count as a higher-order thinking problem. This would classify it as a five in terms of the activity that Maggie posed for her students. Finally, in terms of

technology, the iPads were not really used to collaborate. They were used to make a product, with the overall purpose of communicating ideas to peers. They were certainly using it to communicate with their peers to show what they had written.

Maggie had the highest ratings for student-centeredness 3.38/4.25 (combined/only technology), which may or may not indicate a higher level of ‘expertise’ in using technology, because I only conducted three observations. I think it more likely indicates that she wanted to make sure I saw something that was project-based when I came to observe her. Her lesson showed that she had flexibility when working with students, allowing them to help her come up with ideas for using the iPads; it also showed that she recognized when students were off task, but may not have been completely effective in getting them back on task.

Peter. Peter was an experienced teacher, who had taught many years at Maverick middle school. He was involved in the school for as long as it had had iPads. He was one of only two ESOL teachers at the school. Although the populations of Maverick and Gran Torino were very similar, Gran Torino had 4 ESOL teachers. Peter taught English and social studies to 6th, 7th and 8th graders. Even though he had similar years of experience to Camilla (maybe five years more), he was older. Of all the teachers, he was the only immigrant. He was originally from Ghana, and would probably not have had the same access to technology when he was growing up that the other teachers had had (Oxford & Jung, 2007).

Overall activity ratings. Peter had relatively low scores on his student-centered teaching ratings. While most of them were in the mid to high twos, two scores (activity goals and technology use) are below two (1.82 and 1.74 respectively) (see Table 4-5 and

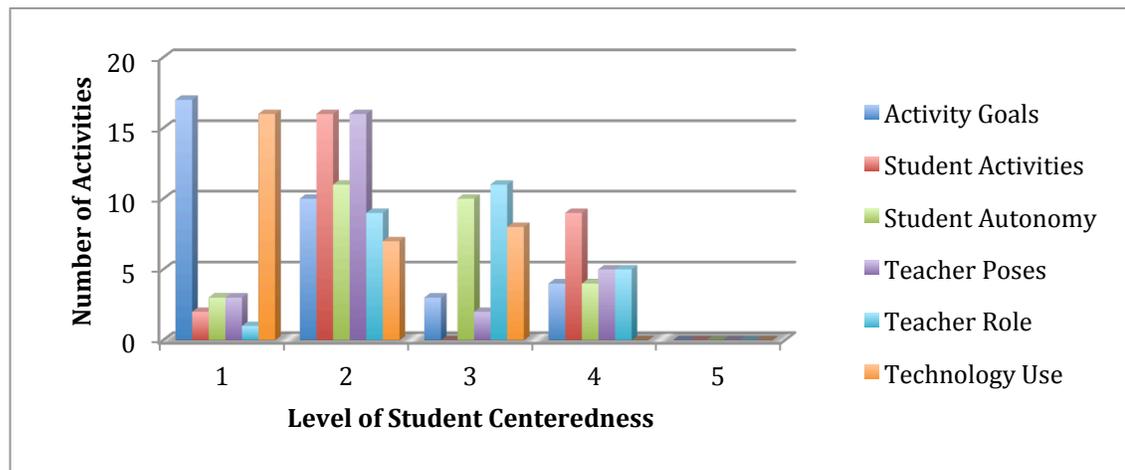
Figure 4-3). Even more interesting is that he had no activity ratings in the five range. For the other “student-centered” rating (4), he only had 27 activities, with 145 other activities in the 1-3 range. The number of 2 ratings was the highest, with 69 overall. Overall, his average student-centered rating is 2.27 out of five.

Table 4-5: Peter’s Student-Centered Classroom Activities

	1*	2	3	4	5	Avg.
Activity Goals	17	10	3	4	0	1.82
Student Activities	2	16	0	9	0	2.59
Student Autonomy	3	11	10	4	0	2.54
Teacher Poses	3	16	2	5	0	2.35
Teacher Role	1	9	11	5	0	2.77
Technology Use	16	7	8	0	0	1.74
Total	42	69	34	27	0	2.27

* Goes from most teacher-centered (1) to most student-centered (5)

Figure 4-3: Peter’s Student-Centered Classroom Activities



As to his technology use scores, he had neither fives or fours on the student-centered rating scale. Of the 31 activities rated for technology use, seven were rated as presentation activities (two), eight skill-based activities (three), and sixteen activities that were rated as either skills-based or tutor. There was little change when I looked at Peter’s use of technology with technology-based activities. The difference had to do with whether he used the iPads and/or projector to present information. His overall activities

rating showed very little change (from 2.27 to 2.28 – see Table 4-6) when non-technological activities are removed – which indicates he does not change his teaching much when he is using technology.

Table 4-6: Peter’s Student-Centered Activities with Technology Only

	1*	2	3	4	5	Avg.
Activity Goals	17	10	3	4	0	1.82
Student Activities	2	15	0	9	0	2.02
Student Autonomy	3	11	10	4	0	2.54
Teacher Poses	3	16	2	5	0	2.35
Teacher Roles	1	9	11	5	0	2.77
Technology Use	15	7	8	0	0	1.77
Total	41	68	34	27	0	2.28

* Goes from most teacher-centered (1) to most student-centered (5)

One sample lesson. Although Peter talks a lot about doing projects, and discusses using applications like iMovie, based on the consistency of his teaching from my observations, the primary focus of the class is the steady progression of reading and creating activities which are heavily structured and provide little opportunity for student creativity or use of higher order thinking skills. This is quite evident in the quantified activity data.

Most of Peter’s observed lessons were almost exactly the same. He varied his activities some in his social studies class (e.g., he did not use either *Rosetta Stone* or *Achieve3000* there). Still he had a lot of activities which transferred smoothly from one class to another. The students showed that they understood the flow of the class by following along in a smooth manner throughout the each class.

For his sample lesson, I chose to highlight one of his language arts classes, the first class I observed on March 13th. At the beginning of this class he had students go immediately to “*TeenBiz* and *Rosetta Stone*”. He then directed them to do *TeenBiz* first.

TeenBiz is another name for the literacy application *Achieve3000*, which is specific to middle school students. The students spent fourteen minutes on this activity, working independently. Peter was actually out of the room for several of these minutes looking for an iPad for one of his students. Students continued working in his absence. At the end of this activity he did a quick transition to another activity.

The first activity would have been rated a two in terms of student activities, one that is working on individual skills (usually drills), in this example reading skills. It would also have been rated as a two in terms of student goals, as the students were working on comprehension activities. In terms of student autonomy, this would have been rated as a four – the students were working independently, with minimal or no guidance. When Peter was in the room, he was working as a task manager (three), making sure students were completing their work and doing it in the way he intended (i.e., *TeenBiz*, not *Rosetta Stone*). The teacher did not present any questions, problems, or “poses” during this activity; the questions were provided by the software program. I did not observe the questions as the students answered them, but during a different class I observed him going over answers to comprehension/multiple choice questions, which could be evaluated easily. He did nothing further with the reading during this class. Technology use was only a two, which would be a skills-based tutorial.

The second activity in the lesson was a cloze activity on the iPad. This was a short activity, because at 7:59 he had them to go to a page in their textbook and follow along with a cloze activity assigned with the reading. Then at 8:00 he wanted to look at what they have done, and by 8:04 he switched to talking about vocabulary. For the next couple of minutes he asked students to give the Spanish meaning of English words. After

this, he quickly moved the students to *Socrative*, an online classroom management site, where assignments can be placed.

When I spoke to him after the class, he told me that the students did three activities in quick succession: warm-up, reading and then the cloze activity. During the observation he mentioned the cloze activity at 7:59, but at that point they were just doing the “warm-up”, which was working with vocabulary related to the reading. After the warm-up, at 8:15, they “read” a story from their textbook, which consisted of opening their textbook to a specific page, and listening to a recording of the text, while the text was projected on the screen. At 8:32 I noted that they would listen to the reading one more time. He also stated that they should pay attention to the reading, because they would be doing a story map the next day. At 8:36 he directed the students to *Edmodo*, another classroom management application. This was where the students did the cloze activity. At 8:43, he directed students who had finished to go back and work on their vocabulary, suggesting they could write sentences using the vocabulary words. Near the end of the class he mentioned the time they had left and that they would go over the activity the next day. Class ended at 8:50.

These activities are all very similar, so I will rate them together, instead of individually. The class seemed fairly fast paced in reading through my observation notes, but significant amounts of time passed without much interaction in any form. In each of the activities, the student activities would be described as working on skills, or a two in terms of student activities. The goals of the activities were to comprehend the text, but students focused mostly on discrete facts during these tasks. They listened to the text and then filled in a cloze activity with missing words. They also worked on their vocabulary

in order to understand the text better. This would be a one in terms of student goals, discrete facts. The autonomy of the students was mostly independent, although there was a certain amount of guidance (in terms of initial directions for the students). Peter also provided help, briefly, for students who could not log into the application. Depending on the activity, they would range from self-directed with guidance (reading), to self-directed, independent (cloze activity/vocabulary). Peter's roles generally were of a director: there was little or no interaction between himself and the students, he gave the directions and expected the students would follow them. This fits the description of a director, rated as a two. Teacher poses, or activities and information he presented to the students, was mostly in the form of direction and/or presentation. However, he briefly answered some single word answer questions when he was going over the vocabulary. Thus, his poses were primarily those of presentation (one) and occasionally presentation with some interaction (three). His use of technology varied somewhat as well. When the students were working on the warm-up, they were using the technology as a production-based tool (three). When they were listening to the reading, the audio and projection of the text was a presentation use of technology (one). Finally, when they were working on the cloze activity, it was as a drill, where students were using their text to assist them in completing the activity (two).

Peter had the lowest score on the average student-centeredness score 2.27/2.28 (combined/only with technology). More importantly, he did not have any 5's on the scale for any of his activities. His lesson demonstrated how he likes to give his students independent activities with fairly simple responses and how he uses his technology as a document/grading management resource.

Camilla. Camilla taught the newcomer groups at Maverick middle school with Peter. While he had these students for their language arts and social studies, Camilla taught the same students mathematics and science. Because of the student population, she had two courses each day of newcomer mathematics and science. Since she had the entire newcomer population, she taught all three grades at the school, 6th, 7th and 8th. When she taught mathematics, she was not the only teacher in the room. She had a mathematics co-teacher (Roselyn) who worked with her on planning and teaching mathematics lessons, because she was not certified to teach mathematics. Camilla was the only one who designated herself as a ‘digital immigrant’, and she defined herself this way because she thought that Prensky (2001) defined the beginning of being a digital native as in the early 80s, although he apparently never was specific with dates (C. Jones et al., 2010). Camilla, like Martina, is on the undefined edge of digital nativism, being born right around 1980, or the late 1970s, and therefore falling within the definition of digital nativism suggested by some that C. Jones et al. (2010) researched. As a digital native, research would suggest she would use the iPads differently (Prensky, 2001).

Overall ratings. Camilla has all of her rating averages at 2.5 or above except technology (see Table 4-7 and Figure 4-4), and this largely because when she was not having the students use their iPads; instead, she was using her overhead projector, document camera or LCD projector to present material. She also has two ratings over 3: student autonomy (3.08) and teacher roles (3.44). The total number of “student-centered” ratings she received was 55, with 37 of those at level 4. The rating with the greatest number of activities was 2, with 54. In combination with level 1 and 3, these total 137,

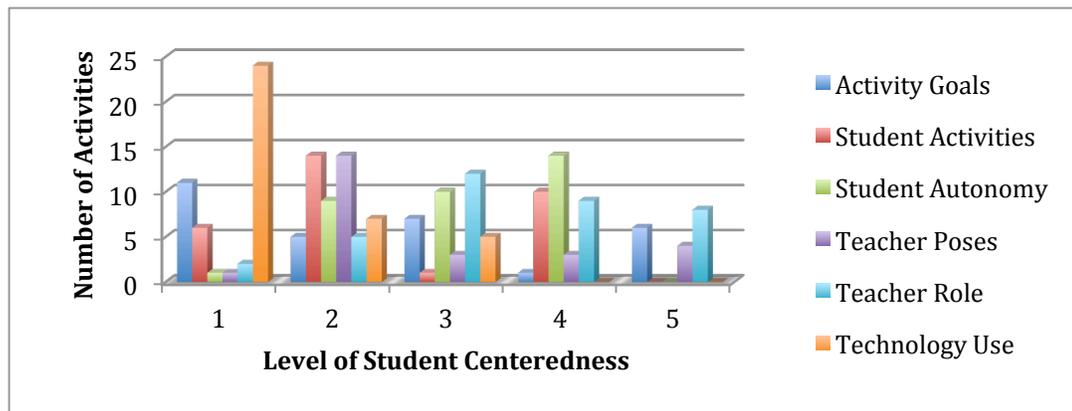
which more than doubles the level four and five ratings. The overall average for her student-centered activities was 2.63 out of five.

Table 4-7: Camilla’s Student-Centered Classroom Activities

	1*	2	3	4	5	Avg.
Activity Goals	11	5	7	1	6	2.53
Student Activities	6	14	1	10	0	2.48
Student Autonomy	1	9	10	14	0	3.09
Teacher Poses	1	14	3	3	4	2.80
Teacher Role	2	5	12	9	8	3.44
Technology Use	24	7	5	0	0	1.47
Total	45	54	38	37	18	2.63

* Goes from most teacher-centered (1) to most student-centered (5)

Figure 4-4: Camilla’s Student-Centered Classroom Activities.



In terms of technology use, Camilla used technology for presenting much of the time (whether it was showing the homework as she corrected it or having the students watch a video on their iPad). She had no collaborative activities; she commented that it was difficult for her to get students to share iPads for a reason that she had not been able to completely figure out. Perhaps she felt it was either too difficult for the level of the students or, though she did not mention it, too artificial in a classroom where you could collaborate face to face.

When using technology Camilla’s overall student-activity rating remains basically unchanged (2.63 to 2.67 see Table 4-8). The scores reflect only minor changes throughout. These scores demonstrate that while Camilla was using a lot of teacher-centered activities, she was making an attempt to work toward the student-centered, even though she has lower level students.

Table 4-8: Camilla’s Student-Centered Activities with Technology Only

	1*	2	3	4	5	Avg.
Activity Goals	9	5	7	1	6	2.64
Student Activities	6	14	1	10	0	2.48
Student Autonomy	1	8	10	14	0	3.12
Teacher Poses	1	13	3	3	4	2.83
Teacher Role	2	5	10	9	8	3.47
Technology Use	22	7	5	0	0	1.50
Total	41	52	36	37	18	2.67

* Goes from most teacher-centered (1) to most student-centered (5)

One sample lesson. Camilla’s lessons were seemingly much less focused on language than any of the other content areas – she only taught mathematics and science. However, many of her projects were language-based, and requiring her students to not only understand the language used to teach the lesson but also to produce language products to demonstrate their knowledge of the content.

For a sample lesson, I chose a mathematics lesson that occurred on March 21st. In this lesson Camilla had students doing a mixture of activities, from checking homework and showing warm-up problems on the board, to watching a *Brain Pop* video, to finally working on a project where they were taking pictures of “fractions” to use in a demonstration of their knowledge.

The lesson started with the students working on the warm-up projected on the board, and writing their answers using paper and pencil. Camilla used equity sticks to

call up the students to the board to project their answers for the whole class. Then she used thumbs up, thumbs down to check on whether students agreed with the given answers. This part of the activity would be rated a two on student activities for the seat work, where they were working on individual skills, and a four for the review of the answers with student/teacher interaction. The activities would be rated as a one for student goals, in that they are working on discrete facts. The student autonomy was mostly self-directed, independent, with some guidance for the review of the answers (three or four). The teacher's role was that of a facilitator (four), with only minimal interaction between the teacher and the students (placing the warm-up on the screen and letting students work on the warm-up independently). The teacher poses (i.e., what was being asked of the students was represented in the warm-up questions) was presentation with discrete questions (two). The technology use was solely for presentation and only during the second half of the activity, when answers were projected on the board (one).

After the class completed the warm-up activity, the students watched a *Brain Pop* instructional video to review their understanding of fractions. Students were able to watch the video independently on their iPads, and answer the questions at the end of the "lesson" to demonstrate their understanding. They were also given the choice to watch the video in either English or Spanish, and the teacher praised students who attempted to use English, even if their success was not as high.

This activity was again focused on individual drills/skills for student activities (two). The goal was comprehension, with some related problem solving (to demonstrate comprehension), so for student goals this would be rated a three. The activity was self-directed, independent in terms of student autonomy (three). Again, the teacher's role was

that of a facilitator in this activity (four). Camilla told her students to open up *Brain Pop* in either English or Spanish and then projected the name of the activity on the screen in both English and Spanish (Fractions/Fracciones). The teacher made no poses during this phase: the interactions between “instructor” and “student” were through the *Brain Pop* activity. This would be in the form of presentation of information and discrete response questions for students to demonstrate understanding. Teacher poses would be rated as a one (for presentation only) and a two (when they came to the comprehension questions). The technology use was primarily presentation, until the questions. Presentation would be rated as a one, and the questions as a two (for skills-based questions).

In the final part of the lesson, the students were asked to create demonstrations of fractions using Legos®. Camilla started off this part of the project with a brief demonstration of her own “incomplete” project. She did this to make sure that not everything the students did was a copy of what she had done: “I’ve done it, the kids have done exact replicas of what I do. I really want them to understand that they are supposed to create on their own” (Post observation interview, 3/21/2013). At one point Camilla noticed that some of the pictures being taken, at least by one student, were not exactly what she was expecting from them, not demonstrating that they were fractions. So, she helped one student create a “drawing” and projected this for the whole class as a sample. The students continued making and taking pictures of “fractions” for the rest of the class period.

This activity was an individual production activity, which would be rated as a two on the student activities scale (individual drills/skills). The student goals were higher order thinking skills/problem solving (five). The students were expected to create their

own examples of fractions so they could demonstrate them in a video or with presentation software. The students were mostly self-directed / independent (although there was occasional guidance). This would be rated as a four in student autonomy. Camilla was mostly a facilitator during this activity, which was rated as a four in terms of teacher role. The teacher presented no information for the students to answer individually during the activity, although the activity as a whole was a higher order thinking problem, which the students had to complete over a period of two class periods (at a minimum). This would be rated as a five in terms of teacher “poses”. I took very minimal recordings of teacher responses, so the one that I have recorded was a response not to the language problem, but to the understanding of the mathematics concept itself. This would be similar to a metalinguistic correction for mathematics, as Camilla worked with the student through the correct form that was needed. This part of the lesson was presented to the whole class and would be rated as a two in terms of teacher responses. Technology was used as a tool to collect pictures and would also be used later as a tool to create a presentation. So, during the time of this class, the product-based tool use was rated as a three for technology use. Later, it might get a higher rating (four for communication) if this product was used to communicate the learners’ ideas to the class or to the teacher.

Camilla’s student-centeredness rating was similar to Martina’s at 2.63/2.67 (combined/only with technology). Her consistency in scores shows that her activities are similar when she uses technology and when she does not. Her lesson, like most of her lessons, was composed of some fairly structured and teacher-centered parts, where the students had certain expectations as to what the class was like, and other parts of the

lesson where students had more autonomy to work within the lesson parameters, perhaps even work on a project.

Teacher Perceptions and their influences on technology use

The role of the teacher in the teaching process has been a theme of much research, especially in regards to teacher cognition (Borg, 2006; Johnson, 2016) and teacher identity (Hallman, 2015; Pennington, 2015). In discussions of teacher cognition and identity, the idea of how teachers perceive elements of teaching is important. Their definition of their role as a teacher using technology, is dependent on how they understand the importance of technology, and how its use will affect how students learn in the classroom. Beyond this, and more in line with current research, the idea that teachers' perceptions of teaching in general would affect how they use technology in the classroom is also an important factor to consider. For this reason, I discuss the philosophies and perceptions of teachers in my examination of what their plans were to use the iPads in the classroom.

Perceptions of teaching. One aspect of the research question was how the teachers' perceptions of teaching influence their use of iPads. In this section I will explore how the teachers perceived teaching through a question from my initial interview about their personal teaching philosophies. This question gives me an idea of the perceptions of their identity and their role in the classroom as a teacher. Each teacher chose to answer this question in a different way, but all of the teachers were focused in some way on the learners and their role in improving the students' lives.

Martina – create independent learners. Martina's philosophy of teaching was to create independent learners. Whether it was independence in research, in learning

language, or in using technology did not matter. She wanted students to learn from her how to work independently of a teacher. As she said:

I guess after my first year of teaching, I realized that if the students still need me at the end of the year, I haven't done my job. So my philosophy is to build them toward independence.... I just believe that I have to move them towards independence. There might be a lot of modeling and assistance in the beginning of the year, but by the end of the year my students are usually self-sufficient, and that's my goal. (Initial interview, 10/17/13)

Martina's motivation to create self-sufficient students, and the use of independence building techniques, especially modeling, was clear in the observations of her classroom. This guiding principle made her class initially seem very structured, but it became less so as the year went on and students became more self-sufficient (see below).

Initially this principle seems like a good fit for using technology in the classroom, as it encouraged students to work independently, and one of the advantages to a one-to-one iPad implementation is the use of the device individually. When working within a language classroom, where the idea is to create a classroom where students communicate with language, independence is an important feature which gives students the opportunity to acquire language skills.

Examining her work, I saw several instances where Martina made clear her desire that her students' become independent. This started with the first observation, where the class spent a whole class period learning how to use an iPad application to record their lab (see description above). During this time the students followed along patiently as

Martina demonstrated how to use the application. It was good that the students were able to complete this lab in one class period so that they could finish the document (one problem with the application was that they could only work on one document at a time because this was the free version of the app). I never saw the use of the application again for science projects, although I saw evidence of this in other ways: once they seemed comfortable enough with the application she gave them a choice of other applications to do similar things; and I saw evidence of long term science projects when they were growing items in the back of the room. It would not be too much of a stretch to assume that at least some of the evidence was recorded on the iPads and later entered into this or another application like it for reporting purposes. Still, I did not see this, nor did we talk about it in subsequent interviews.

Also, I did not get to see Martina using the iPads in collaborative or cooperative ways, aside from an instance (mentioned above) where she had both students recording the lab project while they were each creating a lab report as they were conducting the lab and another with a language activity, where students were practicing parts in a play from a book and recording their reading of the script with the iPad. All other activities involving students were either whole class with one person using technology as a demonstration (either the teacher, or one student), whole class demonstration (the teacher demonstrates, each student does the same on their own), or independent student use.

Maggie – develop academic skills. Generally speaking, Maggie’s teaching philosophy is to help her students develop academic skills and the metacognitive awareness to understand what they need to do to learn about something. As she states:

I need to help students develop academic skills in their second language and metacognitive skills to enable [them] to become lifelong learners and be able to enrich their own goals than from a personal development standpoint.... A teacher has a unique role in a student's life..., and the role of the teacher is to value the students and help him or her to believe in themselves and to know and understand their abilities beyond [the classroom]. (Initial interview, 10/09/13)

Maggie's philosophy that influenced how she taught a lot of the activities I observed were students working independently to solve problems, conducting research or generating language products. Each of these kinds of activities indicates independence and self-sufficiency in determining the language needs of their products. Her role is similar to Martina's, a guide, but she expresses the overall goal of her students differently – to make them lifelong learners.

However, when Maggie spoke about her normal classroom she noted challenges with spending too much time talking and not giving the students enough time to learn. Because of this, she was excited about the idea of a “flipped classroom” in which the students view video lectures at home, and when they come to school their lessons can be more about application of what they have seen. She liked this because her students would be able to be more active in the classroom, and less instruction would need to be face-to-face. She said:

the students aren't necessarily learning when they are listening to me, but when they are wrestling with the material then they learn and I see it in my classroom. And this year, that's one of the things I keep telling myself,

how much of this talking [teacher talk] is really necessary – at what point can I cut it out and do something where the students are learning themselves. (Initial interview, 10/09/13)

This idea of a more active classroom (which could be enabled by flipping a classroom) is visible in the activities that I observed in Maggie’s class, and she certainly spent less time modeling or explaining activities than having students work on them.

In each of the classes I observed, Maggie’s students were using the computers as tools for learning. In those instances the technology was just a way to get to the purpose. Whether using an iPad for research, or as a way of recording their dialogs, or videos, it was not the technology that was important, but the actual learning activity. And while her students did not actually use iPads to collaborate, students were working on collaborative projects in two of the three activities I observed.

Of the three activities, the one which would be considered to be most “academic” was the initial activity I observed, when students were using the iPads for research – as a tool or to explore. The other activities I saw were creating language products to demonstrate knowledge of a particular topic, therefore students were working on the academic skill of communicating their ideas.

Peter – connect with and help students become successful in society. According to his teaching philosophy, Peter wanted to reach and connect with international students and help them be as successful in society as he had become. He wanted to support their education as well as provide them with life skills. He hoped that he could give his students a better chance to succeed in life through education. His ideas were not very different from Martina’s philosophy to help students become self-sufficient and Maggie’s

philosophy to promote life-long learners. However, he seemed reflective about his success, because when discussing his personal goals, he referred back to this challenge and expressed a need to be more successful at reaching his students. Elaborating about how to make his students successful and connecting his goals with iPad use, he said:

So if we read something they don't understand, we can go online and look at... [information]. And if they still don't understand, we can go to *BrainPop* and [learn]... about ancient Egypt or ancient China...; if not they can still go online and..., do some research about ancient China. So it [the iPad] provides them access to so many things. They can read it in English; [and] they can read it in Spanish. So it affords them a whole variety of ways to look at... topics.... So that's what my goal is, to try to reach as many kids [and] to be more in-depth in what I'm teaching them.

(Initial interview, 01/31/14)

Peter not only demonstrates how the iPad connects to his philosophy, but also discusses some 'tutor' and 'exploration' uses of the iPad, in terms of Means' (1994) categories. The iPad augmented students' learning experiences, either through the use of educational tutor videos (via *BrainPop*), or online resources they could explore ('doing research') on the Internet. This shows how his philosophy supports less student-centered activities.

It is unclear what kind of life skills Peter is looking to give his students, as he did not specify these in our discussion. However, it seems a lot of the activities he uses in his classroom are guided to give students habits of learning which they will take with them as they continue their education, like digesting academic texts through the use of text features, predictions, and other reading activities. These seem to be some of the

“academic” skills Maggie was interested in imparting, just with a focus on the linguistic aspects needed to develop higher order thinking skills. And in some way, like Maggie, Peter is using the iPad as a tool to implement these skills. He has replaced paper and pencil with an iPad for his students. He has also replaced his own pen with automated grading. And, of course, taking multiple choice tests is another kind of skill (life or academic) which students need to be successful in school.

Camilla – facilitate student learning. Camilla’s philosophy is very student focused. She indicates that her role is to facilitate student learning, and she tries to create activities that engage learners and enable their learning. Her activities are intended to be contextually-based and provide a means to students’ acquisition of English. However, Camilla has struggled with this philosophy when working with newcomer students:

Students are the ones learning, and I’m there to facilitate the learning. So, I try to do things that engage the students and get them eager to learn. I try to create cool projects or creative projects that let kids show their outlets or their interests. I like to give them [a] choice, because, since they’re the ones learning I want them to make decisions on how they learn. This year that’s proven really hard because I have newcomers, so I have the lowest language [ability students]. A lot of times my projects were built for higher language levels, of English language learners. I find now, for this year, my philosophy has been a lot of ‘teach the basics’, ‘get the core content in there’, and then ‘get creative or hands-on projects’. So that way they have some vocabulary and they have some language to share

in English, because a lot of them will do some stuff in their native language. (Initial interview, 01/30/14)

Camilla has had to adapt her teaching philosophy to make the language activities that she likes to implement accessible to the students who use less English language than she was used to working with. She had been challenged in developing productive activities for students with lower language use. Still, she managed to create product-based activities which allowed students to continue to stretch and improve their language as well as discuss topics on which they could conceptualize, but may not have had the language to explain well. She started with providing scaffolds and then had the students develop their ideas beyond the basics.

Since Camilla was facilitating her students' learning, she had a lot of time where students were working independently as in Martina's class. Also, as in Martina's class, the students were usually working independently rather than working in pairs. Working collaboratively seemed to be a challenge which she mentioned – students did not seem to want to collaborate on a single iPad – they preferred to take turns. For this reason, and because, like Maggie she seemed focused on the usefulness of the technology within the overall academic goal, Camilla did not feel the need to use the iPads all the time. She only used them when there was a purpose for their use.

Perceptions of technology. *One aspect of the research question was how the teachers' perceptions of technology influence their use of iPads. In this section I will explore how the teachers perceived technology through questions from my initial interview and throughout the study. Beliefs are a very personal in nature and can become "unbounded" and apply in situations in which they were not initially*

encountered. Ertmer (2005) discusses this at some length, especially in terms of technology. In 2005 when she wrote about technological beliefs, her opinion was that not many teachers had experienced technology in their own K-12 experiences. And as she stated, these personal experiences (whether from the classroom or not) would color their perceptions regarding the usefulness of technology in the classroom. She also suggested that:

if technology is presented as a tool for enacting student-centered curricula, teachers with teacher-centered beliefs are less likely to use the tool as advocated. Rather, they are more likely to use it, if at all, to support the kinds of traditional activities with which they are comfortable. (p. 31)

The teachers from this study came from different backgrounds with different experiences using technology. One would expect that their different experiences would produce different beliefs about their use.

Positive feelings about technology/iPads. One thing about being in a school where there is an expectation of using technology in the classroom, is that there are rarely teachers who do not have a positive feeling about using it. There may be several reasons for this, but usually for their own reasons, or through being pushed by the administration, teachers who do not feel comfortable using technology will often find a way to leave the school after the first year of the implementation, if not earlier. This was suggested by one of the principals, Mr. Traeger. He wanted the teachers to use the technology and did not resist the transfer of those teachers who did not like using it.

All the teachers in this study presented positive views regarding their use of iPads in the classroom. When I first spoke with Martina she discussed her excitement “So the

new idea of the technology of iPads was exciting...” (Initial interview, 10/17/13). And she continued this excitement throughout the year. “I’m excited. If I’m here next year, I’d hope we get them early. And I’d hope my group would have a cart.... I’m excited because I have the knowledge, so even if we’re not getting the trainings and stuff, that’s after school I could do it...” (Final interview, 6/11/2014).

Maggie expresses similar feelings – both came to Gran Torino because of the iPads. “I thought, oh my gosh, that [having iPads in the classroom] would be great, that would be so useful. I was really excited about it” (Initial interview, 10/09/2013). But she was also concerned because the previous year she had not had much chance to use them in her temporary.

Peter’s enthusiasm was more muted; he did not say that he was excited, but did express his comfort using the technology. Although when he spoke about using technology, he spoke about using it as a tool for personal use – especially to communicate with his family in his home country.

I’m kind of comfortable with it. I don’t use it as much as I’m supposed to, but I’ve always had a... desktop computer at home, and when the laptops came out, I got one right away. I have an iPad, I have an iPhone, I Skype regularly, you know, those kinds of things. (Initial interview, 1/31/2014)

So, while he was comfortable using technology, especially for personal use, his thoughts about using technology in the classroom are more teacher-centered, which I will talk about below.

Camilla had the longest experience with iPads in the classroom. She was on the original team which tried out the iPads prior to the first implementation year. She went

to the initial training sessions which presented Apple's ideas for how iPads could be used in the classroom. And, until the year I conducted my study, she was one of the teachers responsible for promoting good use of iPads in the classroom and supporting teachers technologically. Because she had experience using technology in the classroom prior to the one-to-one iPad implementation at Maverick, she had a more nuanced view of their use in the classroom, although still positive.

I love technology, and I think what was great about the iPad is... personalized learning. It was really the idea that the kids have it [technology] right at their fingertips. Not that I'm opposed to a dictionary, or opposed to using encyclopedias, or books in the library, I still take kids to do that. (Initial interview, 1/30/2014)

Camilla liked the idea of using iPads, but also believes that other tools can be just as useful. She felt that technology will allow students to create personalized learning situations, but would use other tools when they are appropriate as well.

Each of the teachers had a positive view of the iPads, but that was where they started to diverge. Over the next couple of sections I will show some more idiosyncratic characteristics of their perceptions of iPad use.

Useful tool to communicate and provide resources. Teachers' perceptions of TPACK are generally derived from their experiences with using technology in the classroom [i.e., Freeman and Johnson's (1998) teacher as learner]. From their initial discussion of the teacher as learner, the authors posit four potential areas of interest to understand how teachers perceive learning: prior knowledge, development during their careers, context and teacher education.

From Freeman and Johnson's (1998) work we can expect that experience comes initially from those experiences where teachers were students in the classroom. As a teacher gains experience, their perceptions of teaching (and, by extension, using technology to teach) changes. This strongly suggests that there will be a difference in perceptions between those who have had experiences with technology in the classroom as learners and those who have not. Therefore an examination of the perceptions of the different teachers is important.

As I mentioned before, Peter had a more teacher-centered approach to using iPads. This perspective can be seen from his discussion about how he used iPads and the benefits he viewed for the students using technology. Peter believed that he was a different kind of teacher before he started using iPads in his classroom. He grew up in a generation where technology was secondary and teaching was more teacher-centered. However, he suggested that his teaching style had changed as a result of using iPads. It made him feel like he was better able to reach his students.

Peter spoke a lot about how his students could use iPads as a resource. He explained how students could 'Google' images of words that they did not understand and through this online search, either find an image or a video to help them understand. They could also use an application called *Brain Pop*, a web-based educational video repository containing paid content. These kinds of activities would fall into Means' (1994) category of tutor, allowing the student to learn more about the topic through practice and drill.

However, Peter also talked about how iPads and technology assisted him with the logistics of teaching. Specifically, he mentioned how having students work on

assessments on the iPads and hand in papers on the iPad allowed him to minimize his need to grade and collect student work. The computer did this for him:

... because it's [the iPad is] more convenient.... I don't have to copy papers and give it to them and collect them. The technology does that for me. Plus, once they are done with everything, they can just submit it, and I can read it online instead of grading. And it tells you how many responses they have and the correct answers. (Post-observation interview, 03/14/2014)

Online applications that allow for submitting or grading of student work would fall into Means' (1994) category of tool, in this situation allowing the teacher to do something which they could do without the use of the computer, but usually more easily.

The grading and submission applications made it easier for students as well; however, it affected the kinds of activities students engaged in to learn or to demonstrate their knowledge. Activities that can be graded on a computer need to have multiple choice answers, which may not completely indicate students' knowledge – as answers can be chosen at random. Also, these kinds of activities are less student-centered because they do not allow for production, collaboration or (often) responses to higher order thinking questions. While Peter sometimes used the technology to collect written work, he found it useful to grade the work for him as well. In each of these instances, Peter was using technology to assist his teaching, making his work load lighter (literally or metaphorically).

Facilitates learning. Camilla, Martina and Maggie all used technology to facilitate their students' learning (see below for details). In each case I observed project-

based activities in which students were using language to demonstrate their knowledge of content (language, science or mathematics). These kinds of activities assist students in developing language skills through use of language and the needed understanding of how to express their ideas so that they are understood.

Martina – makes things more interactive. Martina generally had a positive impression of iPads and their use in the science and ESOL classrooms. She had chosen to come to this school primarily because of the iPads and the training that would be provided for teachers because she wanted to learn more about using technology. Martina came into the study with an idea of her own usefulness in using technology; she is someone who was willing to take risks when using it in her own classroom. And by the end of the study she was showing how apt this description was in terms of her use of technology.

Martina was just bubbling with enthusiasm about using iPads and Macs in her classroom all through the initial interview, when all she had was training, and had not yet received iPads to use in the classroom. “I mean, I bought an iPad: if I’m going to teach it (then I need to use it); and that’s why I want a Mac...” (Initial interview, 10/17/13). She realized that part of what she was doing was teaching using an iPad in her classroom, so in her excitement, and in order to be prepared for working with her students, she bought her own iPad. She had also completed her transition from a Windows person to a Mac person prior to this time and she expressed the desire to get the Mac laptop which the district would purchase, but without support. The lack of support was something that had scared her off during the last “refresh” (when the county updates their teacher

technology). She was initially excited to come to a school that would give her a chance to work with iPads and be trained in their use.

In the first observation, I finally got a chance to see Martina working with her students with iPads while they were doing a science experiment (described above). It was a drawn out modeled lesson, because it was apparently one of the first with the students using iPads to keep a record of an experiment while they were doing it. They were using a package called *EduCreations Interactive*, which allowed for creating “slides” with pictures, words, drawings and the like. The students had entered their procedures, materials and other ‘write-up’ material using the iPad. It was their language portion of the class in this instance. Martina walked them through step by step, but in the end they had to record everything they had done with their own voice. In her discussion of the lesson, her excitement about using the iPads was still evident. As she said,

I like the iPad, one thing it pushes the students to [work].... [They] have to record on *EduCreations*. Initially the students hated that, they were afraid [of] how they [would sound] read[ing].... And so they were hesitant to talk and that’s one of the issues that ESOL students have to push past.... And so... the first couple of times we used *EduCreations* they didn’t want to or they were shy.... But this makes them try... even if they can’t pronounce a word... and they can retry, retry.... (Post observation interview, 1/31/2014)

The key here was that Martina’s excitement about using the iPads in the classroom was pushing her to challenge how she taught language in science. She saw the benefit of 20-30 students, in the same classroom, recording their voices presenting what

they had just done to conduct a science experiment. The students were able to spend a significant amount of time practicing and recording their voices, until they were comfortable. This practice gave them a chance to work through some of their performance anxiety and get a fairly polished presentation. So, while this was a long demonstration about a science experiment, there were benefits for individualized production of language through the use of the ‘tool’ *EduCreations Interactive*.

Here again, Martina was using the iPads for a full class in a fairly early part of her time with using iPads with her students. I did not get to see her during November or December, and barely got to see her in January. I think this delay meant that she had had the use of her iPads with her students about three months prior to her first observation. I think she wanted to delay that first observation, so she could get over her own performance anxiety. But there may have been other issues, such as state testing, snow days, and as an iPad school there may have been other kinds of observations.

By the time April came, Martina had been using *EduCreations Interactive* for a while with her students and was looking for other applications, but she never really found anything that satisfied her in terms of ‘writing’. By this time, she was teaching her professional learning community (PLC), in which she was learning and teaching about different applications she could use with her students in the classroom, while they were teaching her about what she would teach, one or two weeks in advance. It was through the trainings for the PLC, and her teaching of it, that she learned about augmented reality (AR) and quick response (QR) codes. So her excitement for using the iPads was expressed in terms of things she was thinking about doing with these last two items:

I'm excited..., and ... that's the whole thing with the iPads.... They want the word wall to be interactive, but imagine, if you go up to every word, and if you have a video show up, with a student defining it, or using it in a sentence, or giving you the Spanish... translation, or a picture. And again this is ... [a] thing I [can] create, but we're trying to see if the students can create it. So, there's just... so many things that could be done. (Post observation interview, 04/25/14)

Through the use of QR codes or AR Martina hoped to create an interactive word wall where students would create images, videos, text files, which would come up whenever someone pointed their iPad to a particular word on the word wall with the appropriate software. This would be a form of 'communication' based on Means' (1994) categories, using a 'tool' to set up a one-way communication.

This plan shows some of Martina's thinking processes about how she was changing her classroom and instruction. She was reimagining how she could teach in the classroom through the use of the iPad. No longer would students have to look at the word wall and see just words. Now they could point their iPad, and the words would "come to life" to support their learning. And if the students created it, then they would be actively involved in the creation of the tools other students need, like virtual word walls:

So to me, to see... that [QR codes] could change, instruction [is amazing].

For me, I always thought the iPad was a tool to help the kids read books on their level. Which is still a struggle – I'm still trying to find free sites or free places for books on their level. Or [it is for] these science apps, like I finally found ways for them to see stuff. [But,...] to change the

structure in which I teach or set up the class I didn't think that much about it. But now it's exciting. (Post observation interview, 04/25/14)

When Martina started teaching in the fall, she just wanted reading books (physical or digital) for students to read independently, some science applications for her students to work with in her science class, and maybe a writing and/or presentation application. But with QR codes and AR, she was beginning to see the possibilities of really changing how her classroom worked. She wouldn't get to realize it in any real way during her first year, but she had the potential to take her teaching to another level. Of course, there would be challenges with her dream. At that point she was just thinking about content-based aspects, not pedagogical ones. Teaching the students how to use *Aurasma* or other applications, and working out a way they could use these applications in the classroom, would be another challenge. Still, she had already worked through these challenges with *Educreations Interactive* and many other applications, so she could probably work them out for *Aurasma*.

By the end of the year Martina was excited as to what she would be able to do the following year. In a way, this year was a trial run for her. She was teaching her students, but also learning what applications were available for the iPad and how she could incorporate them into her classroom learning. She discussed several applications like *The Rosetta Stone*, *Aurasma*, and *Achieve3000*. Using these applications would take her classroom to another level, both in interactivity, but also in the language challenges for her students. While Martina seems to be acknowledging the need for basic language skill development, she still wants to have her lower language level students work on challenging their language skills to produce and communicate.

Maggie – novelty assists in engagement. Like Martina, Maggie had also started working at Gran Torino because of the one-to-one iPad project, having heard about it during her student teaching. There was a job available at one of the iPad schools for an ESOL teacher, and she took it. Her excitement about using iPads with her students was, however, tempered by the limitations of her situation. Working in a temporary classroom outside of the building made it difficult for her to use iPads with her students every day. She described her excitement in this way:

I feel bad that I can't use them; I wish I could use them; I would love to have my students use blogs, and be able to put a lot of the information online... so that the parents can access it, it overcomes a lot of the other challenges, like the copy machine. (Initial interview, 10/09/13)

From this initial discussion one can see that Maggie's focus on the use of the iPads was fairly heavy on using Internet-based applications, "blogs", "put[ting] a lot of the information online", etc. Her focus in this sense was very much directed toward using iPads as a computer, and using it to produce language and 'communicate'. And two benefit of using a computer how is its functions as a word processor and as something that can be used to access the Internet. Maggie said as much when she discussed her ideal technological implementation:

I think that if I were designing a technology program, I might give them *Chromebooks* instead of iPads, because a lot of... the academic skills that they need to learn how to do for high school or college – like typing a paper or something... or making on a spreadsheet, are not necessarily on an iPad, or they're not easy. (Initial interview, 10/09/13)

In sum, her ideas were developing academic skills, typing, working with a spreadsheet and, perhaps, doing research. These are all product and/or process-based activities, some of which require an Internet connection.

When Maggie discussed her most interesting lesson using iPads from the previous year, she again focused on academic skills, in this example, doing research online:

... I had them choose one of the cities that was in the book... [and] I wanted them to research [it]. So they had to find internet research, they had to research to find one additional fact about the city, not in the book and post that to a blog, as well as their opinion of which city was most interesting and why. And with that, I was... thinking with this idea..., digital literacy these students their most pressing need probably – academically and professionally – is how to find and evaluate information, especially online. So I thought that this... lesson was a nice way to... be able to search, find... [and] repost... [the information that they had found]. (Initial interview, 10/09/13)

Going into another school year, with limited access to the Internet, she was still thinking about projects and activities which have the Internet as a main component. She thought her students needed this skill, and she was focused on it giving to them. She was thinking of the iPad as just another kind of computer, with a different interface.

iPad use can be significantly different than using a computer in the classroom, even one like a *Chromebook*, though that may be changing. There are more applications on computers than on iPads and other devices which accessed only a certain portion of the Internet (like smartphones). And some of these applications access the Internet in a

special way: *Achieve3000, Aurasma, BrainPop, DropBox, Edmodo, Google, QR reader, Notability, Pandora, Safari, Socrative*, etc. While many more applications do not need the Internet to function properly, these applications were limited by that very idea – and in the classroom like Maggie’s, limited in its ability to access the Internet, a teacher would have to be more creative to use iPads with their students. So, perhaps her digital nativism was limiting her ability to see the potential of the iPad as a device to work offline. She was a digital native to a computer connected to the internet, not an iPad with other abilities.

In observing her teaching, one could see her dependence on the Internet. In the first observation (03/24/14), she had planned one thing for her class – but had been surprised by a second class joining in. They had been talking about merging the two classes (one of a slightly lower level) for several days, but she did not know about the actual merger until the day it happened. She was at least prepared enough to attempt to conduct two separate classes (because both groups were working on different things) at the same time.

During this class session one group of students was supposed to do research. After managing the class, reminding them of the rules and conducting a warm-up and after the students had worked on part of their project for several minutes, Maggie started talking with the students about the next step. She first asked them what the *Google* search term was that they should be using, and got the response “Christopher Columbus Route”. Once she was satisfied that they understood what they were doing, she invited one side of the class to go back and get iPads. The iPads were stacked in the back of the

room, and (at least on this day) there were not quite as many iPads as students in the classroom.

As she was in the classroom, having her students do an Internet search for the exploration route for Christopher Columbus, some of her students were searching for this route. Other students immediately went to *YouTube* to find music to listen to and still others were attempting to connect to the wireless network. Several students complained about the connection. She told them to reset their wireless network connection as a way of fixing the connection issue. The students themselves, although occasionally complaining about the lack of connection, seemed familiar with this situation and found other things to do while waiting for the iPads to connect to the Internet; Maggie acknowledged the problem, but did not really have a solution.

When I asked her about the potential problem with the students using *YouTube* while other students were trying to connect to the Internet, Maggie responded in this way:

So my mod 5 class, the small class, I've taken them to Mr. Chan's room before, because he doesn't have a class Mod 5. So I'll just hold class in his room, when I need to use the iPads. For example, when they were doing a research project they would have class in his classroom everyday. And then it wasn't a problem [if] they would listen to music or whatever they wanted and still be able to use the Internet. I haven't talked to this class about it, but I guess I definitely will. (Post observation interview, 03/24/14)

As discussed above, Maggie liked using the iPads for the students to do research as the Internet provided a wealth of information. However, she didn't usually do these

activities within her own classroom or with so many students at the same time. As the challenges provided by her weaker wireless signal and the bandwidth demands of students using *YouTube* had not been an issue before this class, she had just ignored it.

By the end of the year Maggie seemed to be coming to the conclusion that she needed a greater variety of applications to use on the iPad and needed to focus on those which did not require the Internet. She had just finished Martina's PLC and was excited about using applications that were Internet independent:

The timing of the training [PLC] was also a challenge. I've just really wished it'd been the beginning of the year. Because I feel like I got so excited as I was going to the training about everything else, "Oh yes, this is really great. I want to try this out right away." And then the iPads got taken away so soon after. And... that was one thing that was hard... at the end of the year, I... felt like I was just figuring [it] out, so I would be planning lessons and oh like we can use the iPads for this and in class....

So, maybe for next year. But we'll see. (Final interview, 6/12/2014)

By the end of the year, Maggie was beginning to think about how to apply the PLC training that she had received and was going to change her teaching yet again. This passage also points to her inexperience with teaching, or at least her comfort level with adding something new. She mentioned how she was 'just figuring out' how to integrate some of the apps, when she lost her iPads. Martina would talk about how she had looked at something the previous evening and then immediately tried it in her class, while Maggie took more time to bring it into her class. An expert teacher with a high level of TPACK would be able to anticipate the kinds of challenges associated with using

technology in the classroom and plan through that. Maggie was aware that there would be challenges, but was taking her time to try things out prior to using them in the classroom. And while not a bad method, it showed that she needed more practice with using technology to teach or just practice teaching to be more comfortable with it.

Maggie thought that she might use applications that were Internet independent in her classroom that was very Internet challenged in the subsequent year: “I feel more excited about next year..., [be]cause I’m learning about more things that are Internet independent” (Final interview, 6/12/2014).

Camilla – should be used sparingly, but provides for creativity and choice.

Camilla was the most interesting of the cases, because she was a cross over case with a combination of several years of experience and being fairly close to a digital native as well as having experience teaching media production prior to teaching ESOL. She considered herself too old to be a digital native, although she possessed some of the same abilities that most digital natives would be considered to have. Her experiences brought insightful ideas to her approach to teaching using iPads. These experiences allowed her to see beyond the usefulness of having an iPad in the classroom to the challenges which develop as a result of teaching with them. After working with iPads for three years, she seemed to have a concept of the challenges of working with students who have limited English use and are trying to use iPads to learn English.

Camilla was an experienced teacher, but at the point of this observation had only been teaching ESOL for about five years. Most of her prior classroom experience was in teaching television and video production. This experience colored the way she thought about teaching and producing projects, because she was constantly thinking about

storyboarding and the various stages of “production” of the project. She and Peter were both around when the iPads were initially proposed as a solution to struggling Title I schools. She was one of the initial evaluators of the Title I program and was also initially a member of the “iTeam” – a team of teachers tasked with supervising and maintaining the iPads, a role she gave up at the beginning of the 2013-2014 school year.

Initially, Camilla had a lot of questions about how iPads could support English language learners (ELLs), what Camilla calls ESOL (English for speakers of other languages) students.

I was asked to go to a meeting and it was in [a neighboring state], and it was with Apple, and it was talking about how we could bring Apple back into Rollings County. So I went into this meeting, and there was this lady there..., who is this big pow-wow in using iPads in Technology. She did this presentation about using iPads in the classroom. And she actually, she said, “you made me think about using iPads in a different light,” because I was an ESOL teacher now, I wasn’t a Video production teacher, I was an ESOL teacher and she’d show me something and I’d [ask], “How would an ESOL student do that? How would I slow that down for an ESOL student? How do I add labels in there? How do I do this, how do I...?” And so, she’d actually change part of her snazzy presentation to add the idea of English language learners in there. (Initial interview, 01/30/14)

Camilla was really concerned about how iPads might affect her students’ learning, channeling her knowledge of ESOL students and teaching. She already had knowledge and beliefs about how students learn, and she was trying to apply this knowledge to iPads

– a TPACK for iPads was beginning to form. Therefore, she challenged the initial presentation to make them consider the challenges of supporting language learners with them.

She was also not convinced that a one-to-one implementation of iPads was the best use of resources for her students or the school.

I'm not too sure that the school needs to provide one-on-one, unless there is some type of monetary, and responsibility guarantee with the students.... We don't have a theft problem, we have a disrespect or damage problem, in terms of kids damage[ing] the covers.... Some kids can't scan QR [(quick response)] codes on their iPads because the plastic that covered the back on the hard cover has been scratched up so much, because kids get bored and they damage it. And we have not as a school or a county, enforced the policy of kids replacing [the iPads when they are damaged]. When a kid downright damages and cracks the glass, we make the kid either replace it or pay... [but not when the damage is less dramatic]. (Initial interview, 01/30/14)

Camilla was challenged by the idea that iPads were useful but were not being respected by the students. Here she was expressing her knowledge of the student population and applying it to the situation. She understood that the kids were not being responsible with the devices because they were not made responsible for their damage. Her knowledge of teaching practice demonstrated that she understood that using iPads without student responsibility was going to make her students less respectful of the

devices, and result in more damage. Perhaps the magic of the iPad had worn off somewhat, or when students did not use them, they played with them in other ways.

Camilla was thinking about this critically, with three years of experience using iPads. She had attained a certain level of TPACK for using iPads with her students, in the context of her own schooling, and was beginning to see challenges associated with their use. Here she was working the pedagogical aspect of using iPads, or technological pedagogical knowledge. This knowledge of using iPads with students also provided her with additional insights:

I think part of the problem is, when they pitched this idea to us, the kids were going to be able to take them home.... And this year..., we still haven't... [had kids take them home].... And so..., we have... a lot of teachers... [who say], "Oh, I can take notes on the iPad, kids can take their notes on here, they can do all this." But if they don't get to take the iPad home, then you lose something when they get home and they need to do homework; or you lose something when they're supposed to finish their project at home. [Because]... it is on the iPad and how do you do that. So I find that... the happiness of having the iPads..., that good feeling has deflated a lot, in our third year of having them. And the frustration that cool projects that I find or that I design end up taking longer, because we can only work on it in school during class time.... There's no down time for the kids to be on their iPads. So they don't have time to work on it on their own. They can't take them to lunch. They don't have them first thing in the morning for that 20 minutes before the morning show starts. I

think my happiness, or my positivity or my optimism of all the things I can do has been significantly reduced. And I try to find ways that I can enjoy using iPads in class, and the kids will enjoy, because I think that is part of the problem. They're sick of taking notes, they're sick of getting on *TeenBiz* [*Achieve3000*] and getting on to *iXL* and all of these websites, like "great we can get on this again - woo-hoo", so I do try to find projects. (Initial interview, 01/30/14)

Camilla obviously had a lot concerns about how to best use iPads in schools.

These ideas stemmed from frustrations, but the biggest of the frustrations had to do with how students could save their work to take it home with them or work on it during other times of the day. Prior to having iPads, if a teacher wanted students to take work home, all they had to do was to take home their notebooks and a textbook. Now, if students did work or took notes on their iPads, then they had to have a way of accessing that work electronically at home. Unfortunately, for many of these students, that meant they had to take their iPads home. Since the iPads remained at school, students either ended up doing their work only at school, or the teachers had to plan ahead to either have a way of doing part of their work with a paper and pencil, or making sure that all of their students had a way of transferring their work to a computer that they already had at home – assuming that they had a computer.

Here, Camilla's knowledge of teaching practice and the need to extend work beyond the classroom demonstrated that she understood that the current use of the iPads only in the school might challenge her to provide activities on the iPads which were relevant to learning, interesting to the students, at a level that they could find useful, and

something they could do in the limited time they had a school. And while the idea of taking the iPad everywhere with them seems simple enough, school systems have concerns with the idea of students taking home expensive county property. She suggested that her students only had the opportunity to do their work in the classroom, and take paper work home with them if they were given it.

Again, these are pedagogical challenges discussed by Koehler and Mishra (2005), and something associated with the context of the school and schooling (Freeman & Johnson, 1998). As an experienced teacher, Camilla has thought through these issues carefully, as well as other challenges she had with using iPads in the classroom. Her knowledge of language instruction and her beliefs about how students learn provided guidance on the choices she made in the classroom. One of the pedagogical choices, which involved her developing TPACK, was the use of *Google Translate* – as the ultimate translation tool. There were two problems with using technology as a translator, according to Camilla: one was that *Google Translate* did not work so well past the one word level, often getting very odd translations; and the second was that her students would not be able to use it during testing. Once again, Camilla is thinking about the effects of using technology on student learning, and how the technology was interfering with the students' abilities to learn how to translate and use dictionaries.

Another challenge for Camilla was note taking. There were times when she wanted her students to be able to take notes, and sometimes she would give them a document with at least some of the information in it so that they could highlight and augment what they learned from a presentation. The challenge, when working with the iPad, in an application called *Notability* was that the students got caught up in the

mechanics of it – what color to choose, how thick to make the lines, etc. – and she felt that they lost the ability to actually pay attention and take notes. Sometimes students even lost everything that they had done and had to ask for her to start over again. Clearly, taking notes on an iPad is a skill that needs to be worked on, and if it is going to be done regularly, then students need to learn how to do it well. Or, teachers need to bypass the iPad and have students take notes elsewhere, perhaps so they can access them at home.

It was a struggle for Camilla, because she indicated that iPads were useful, and as a tool they could be very helpful for students. But, apparently, this year especially, Camilla found that there were many challenges when working with students, especially the lowest language level students. And although she did not have any hard data, she questioned the usefulness of things like *Google Translate* and spell check and grammar check in applications, which encouraged the students to become lazy in their use of language. Camilla thought that perhaps students would not even bother to learn beyond the bare minimum of what they needed to do to become proficient in the tasks that they were working on. From these observations we can see that Camilla is really focusing on TPACK. She is not only thinking about the content implications of teaching with technology (whether math, science or language) but the resulting pedagogical implications – the challenges that occur when you try to teach using technology, and how these, in turn, affect student learning as a result.

Of all the teachers, Martina and Camilla are probably closest in terms of their knowledge and abilities to use technology to teach. However, even Martina was not problematizing the use of technology in her classroom at the end of her year, as she

struggled with integration. Martina had not expressed any concerns about using technology with her students at the end, except for what software to choose to best work with her students. She had only thought about her learning practices, how she was going to change her classroom the following year, and how wonderful it would be.

Perceptions of using technology. One aspect of the research question was how the teachers' perceptions of using technology influence their use of iPads. In this section I will explore how the teachers perceived using technology through questions from my initial interview and throughout the study. Teachers' perceptions about the use of technology will influence their identity as teachers using technology and the ways in which they will use technology. There were a few ways in which the subjects perceived technological use in this study. The teachers were not limited to just one of these perceptions neither were the perceptions indicative of a particular teacher. Instead, the teachers had either stronger or weaker aspects of each of these perceptions, which could be classified as a part of their technological identity.

Perception 1: To assist students in learning. Each of the teachers had some experiences with using technology to assist students in learning. Maggie used technology to assist students in creating their projects and finding out information. Students could have presented information about their "creature" to the whole class as some kind of oral presentation. They would probably have spent less class time developing their "product", because they would not have made a video. However, even if the "product" was shorter, they may still have wanted to practice their presentation before hand, which may have led them to use a similar amount of time. In this instance, not only did some of the students fail to complete their project, but none of them got to see the final project (including

Maggie) because the iPads were taken away. But, potentially, having the product on a computer would give students a chance to view the product multiple times, and even share it with a larger audience.

Martina felt strongly that through using the iPads, students would get additional practice using the language. She spent a lot of time initially with an application giving students time to get comfortable with the ‘right way’ of creating student products. Then, potentially (and she spoke about this implicitly) the students could have completed their projects on their own time. In this way, she advocated giving learners time to practice more using language and to become more independent in their project development. She even wanted to give her students the opportunity to choose the particular applications they felt were most appropriate.

Camilla similarly wanted to develop her student repertoire of applications that they could use to produce language products about the content being taught. Through her time in working in television production, she was well versed in the idea of creating student projects and project-based learning. She had also spent several years working with students, usually with more English use, creating similar kinds of projects. This was her first year working with lower English use students, and she had been struggling to produce similar projects. Still, this was her goal, and throughout the year she spent a lot of time fashioning projects her students could use to learn about the content areas of mathematics and science.

Peter did profess to try to assist his students to learn about language through connecting them with information on the Internet. And while this was his intended goal,

it may have also been a way of making the task easier for him through the use of computers. I will talk about this more in the next section.

Perception 2: To assist teachers with administrative tasks. One of the themes which seemed to run through most of the items Peter spoke about was how much easier it was to teach when using iPads. As I mentioned above, he spoke about how he did not have to collect papers and had fewer things to grade, because the computer could do it for him. I also mentioned in the previous section that he felt that he was able to assist students more because he could provide them with ready information regarding vocabulary and concepts that were more abstract. This could also be a way of making his teaching easier, as he did not need to prepare for potential challenges to understanding, but could have students do an Internet search for understanding at the moment. Of course, this is not without risk, as even in a protected (locked down) environment, searches will (sometimes) produce unintended results.

Perception 3: As a resource for student acquisition of technological knowledge. Each of the teachers had some experience during the study period of being a resource for their students to learn about technology. Learning about technology is an important goal because students from some other countries may have less experiences with using technology in their home country, or may not have the ability to purchase technology in this country because of (at least initially) limited resources. This may not always be the case, but the idea of several kinds of digital divide have been expressed over the years, and Hispanic students are often considered to need additional support (Oxford & Jung, 2007). Some of the resource ideas that the teachers expressed over the study period included using iPads to support knowledge-based learning for a content area, to promote

reading or writing, to develop multimedia projects, to support vocabulary development, and to support teacher/student interaction.

Martina. Martina has several years of using technology in the classroom, although she had not used iPads before the year of this study. And she had some specific goals for what she wanted to do with her students in the science classes she teaches. Her goals were as follows:

I'm all ready with science [and] I'm really excited because I already know about just certain science experiments or sites that there are online, that the kids can do. I can take them to the computer lab, they can do that on the iPad. In the training I saw certain apps, about... astronomy, or... dissection. We dissected a frog, and then we dissected the skeleton, so with science I'm really excited about using the apps, and the Internet for that. [What] I'm also wanting to use is... [*iMovie*], I haven't been trained yet, but when kids experiment, or when the kids are presenting [that would be useful].... I want to do... a volcano experiment and stuff with them, but I'd like for them to do use the iPads to... do their own "Bob the Science Guy", their own videos, [with] them teaching others to do it [something scientific], and... posting those. So for science I'm... totally ready and eager. (Initial interview, 10/17/13)

Here Martina was talking about several kinds of applications with which she was familiar and had learned about through Apple trainings. *iMovie* is an Apple application which records videos and allows editing. Other items are science-based applications which are specific to, and generally for, hands-on science learning.

An interesting point of this passage is that Martina talks about different kinds of applications based on their focus. She speaks of science applications, with which students can virtually engage in gathering scientific data (like dissecting frogs or exploring the universe). However, she also talks about recording science experiments, for example like where she wants learners to create something like the video personality “Bob the Science Guy”. With this second type her focus is not on the science, but on the language product students would need to make and the ways they would use language to express their knowledge.

With reading classes Martina was not as sure where she wanted to go, in some ways like the language focus applications for science. This demonstrates a difficulty associated with the differences between using software to teach science and language. Science has a lot of applications which allows for hands-on experimentation on a particular scientific topic. While this is also possible with language applications, many of these kinds of applications focus on drilling specific skills, discrete points of knowledge. However, when focusing on process/product for language, the best applications are generally ones which allow for the creation of a final product, but they do not incorporate much in terms of activities to monitor or promote process development. For this reason, it is much more difficult to find applications for language development. Thus, with the language product applications on the iPad Martina did not seem to have as much experience and/or knowledge. The reason she was challenged in using iPads for reading is possibly due to the fact that the trainings that she attended were mostly focused on applications which would help with science – applications which were specific to a

learning task. There did not seem to be any language-based applications which she discussed from these courses. Or there were too many to list:

With reading, I think it might be... [using] *Edmodo* with assignments and so forth. But I think with the book publishing, trying to find a good site with that or journaling or.... I need to research about different writing tools, because there's a lot out there, but which one I would like them to [use, I do not know]. I already know... on my iPad they have *Note*, and they can... e-mail it to me..., but something more [an application] for... [developing writing]. I do want the kids to write their own autobiographies, so I'm excited... with the iPad..., [because] you can use pictures. You can also take their pictures..., creating their autobiography.... So for English I think it would be more creation, and production writing, creation and production as well as reading. We already mentioned... [*Achieve*]3000... and *Rosetta Stone*. So *Rosetta Stone*, *Achieve3000*, and writing books, and journals and, possibly, if they're sight words, I was thinking about site word cards, I'm sure there's some kind of app or program that could review site words, or spelling bees. (Initial interview, 10/17/13)

Martina started thinking through several possibilities for production applications for her reading class. She did not yet have a clear idea which application she might use, and as the year went on she never really settled on an application. But she was also looking to supplement the student reading materials, and here she changed her discussion to more hands-on applications: *Achieve3000* and *The Rosetta Stone* (see Appendix A). *The*

Rosetta Stone is a software package with which Martina was familiar, and while she had heard about *Achieve3000*, she had not yet had the opportunity to use it.

A lot of the software that Martina talks about in both situations would be considered a ‘tutor’ in terms of Means' (1994) categories. Almost all of the science applications seem to be skills-based, e.g., astronomy and dissection. *iMovie*, however, has the potential to be a language production application, a ‘tool’ in terms of Means' (1994) categories. The language applications also seem to be working on a skill in many situations. *The Rosetta Stone* and *Achieve3000* are both in the ‘tutor’ category, although they move a little toward production. What Martina struggled with the most, for language development both in her science class and language class, was finding applications which would support language production – more ‘tools’. There are not any applications designed especially for teaching language production, although there are tools which can be used to produce language products. The challenge here is to find something that the students will use, be easy for them to use, be the right price range (free), and give enough support for language learners to be able to write or speak while developing their productive skills.

Maggie. Maggie had already had some experience with teaching with iPads when I first started observing her. She also had some challenges with working with the iPads, because of her location in a temporary classroom and the limited access to wireless networking. In her mind, this technological challenge limited her ability to use the iPads effectively. Still, she had had at least one good experience in her first year. She had taken her students to The White House using Google Maps and was able to do a virtual tour. She describes it in this way:

I took everything that I wanted them to do, and I think it was on fact and opinion.... How could I use technology [to] give them to that point. So we had read the book [on a particular city] and then, I knew that I wanted them to... use technology to be able to search and find – which is something that they really struggle with... – pictures of different cities. And I was thinking I would like to go on *Google* and play around because it's awesome. So I was thinking, what a great way for students to experience and get excited about this book, because we're going to do a project on cities, for them to... be able to see this especially with... The White House. A lot of them have not had an experience with The White House. It is hard to do: you have to have a background check to do it. But for them to kind of connect with the reading in a way that was really engaging and interesting, [really added to that experience]. (Initial interview, 10/09/13)

In this way, Maggie was able to expand the experiences of her students, who may not have been able to visit The White House in person, even if they could travel the short distance to Washington. This made the experience real for her students and gave them the chance to experience the purpose behind the writing and gain greater understanding of it.

This activity was something that she did at the end of her first year using the iPads. But in order for her students to go online and experience the virtual world, she had to schedule this class to meet regularly within the building. She was able to schedule the class in the building because one of her fellow teachers had planning the same time she

had this class and was willing to give up his room. So, one of her more important goals for the new school year was to find places to take her class within the building or hope for the technology to work better in her temporary classroom. As she said:

I have to scope out where I can use the iPads.... I'll have to kind of start the year out and see what the situation is like in terms of finding a place to use and how good or bad the Internet is, before I really have a plan....

That's the other thing, you don't necessarily want to plan reliance on the iPads, because the Internet cuts out, or the iPad cuts out, or one of your students doesn't have it.... (Initial interview, 10/09/13)

Much of what she had to say was predictive of what her year would be like. Maggie had experienced challenges with Internet access before, so not having the Internet would be expected. However, not having iPads for her students may have also happened before, although she didn't mention it. But it foreshadowed the challenge she had when Martina had control of the iPads, and she would be at Martina's mercy for whether she got to use them or not. This came about because of increasing numbers of students and limited number of iPads.

Peter. Peter planned to use the iPads to help students develop their knowledge, using them to support the content that they were exploring. In one example he worked with a social studies unit on either ancient China or ancient Egypt. He provided resources for students to gain a better perspective, for them to become more familiar with the topic at hand. He described a typical unit in this way:

Right now, we're going to start ancient China.... So the first thing would be..., [to] do something... [regarding] the text features.... So I would ...

[use] some graphic organizers that I've created that I'll send them through *Edmodo*. They'll look at the graphic organizers on *Edmodo*, look at the pages and so on in the textbook and fill out the graphic organizer. That is the first thing that they would do. Then from there, I'll... maybe go to *Socrative*, and do something like... the key vocabulary... and the following day I'll set up some vocabulary activities on *Scorative*.... After that we would read the text. After we read the text, we would go to *Edmodo*.... [And] I'll tell them to go back... and look at the topic and I'll tell them what to look at with ancient China: look at The Great Wall of China and so on, and take... the assessment... that comes with... [the text]. And then... *Socrative* grades for you. That's another great thing about the iPad. I don't have to take all these papers home and... grade [them]; and its real time. As they are doing it, as soon as they are done, I just put my grades down. (Initial interview, 01/31/14)

Peter's discussion here was a description of a typical social studies lesson, which he started in the context of a unit on ancient China or Egypt. His goals were to use the technology as a way of adapting his lessons, and giving his students activities which follow a specific step-by-step plan. He used very specific software: *BrainPop*, *Edmodo*, and *Socrative* (see Appendix A). These applications made it easier for him to share documents (tool) and grade assessments (tutor). As noted above, Peter often is using technology to support his management of materials and allow students to work on skills.

Camilla. Camilla had rather "grandiose" goals for this year when she started out, but by the time I first met with her, her situation had changed and she was working with

different students. She had a lot of ideas for how to work with her students, based on her philosophy of facilitating project-based learning. But because she was getting used to the idea of larger classes of lower language use students and teaching mathematics as well as science, she made some changes. One change she had made from previous years was to make the projects smaller:

By doing it small, I've learned that... [m]y projects have succeeded more, I should say. Maybe if I started these small projects in the fall, we could do bigger projects now. Maybe if I teach the same thing next year, then I'll have these projects to fall back on, which I've noticed from other teachers. (Initial interview, 01/30/14)

Because she was working with lower language use students, the kinds of projects she had done in previous years just did not work. But she did not cancel the projects, just made them smaller. And I would like to emphasize that she had taken some hints from other teachers and used them as an example for how to change her work. She wanted to use this school year as a model, as a practice run, in circumstances where she had these students again next year.

Perceptions of students. One aspect of the research question was how the teachers' perceptions of students influence their use of iPads. In this section I will explore how the teachers perceived students through questions from my initial interview anytime throughout the study they discussed their students. Another factor to be considered in the perceptions of teacher cognition and intentionality is their relationship with their students (Kubanyiova & Feryok, 2015). Since any interaction is a dialectical interaction, with both having at least some agency in terms of their ability to control the

interaction, perceptions of the situation in all forms is an important factor to consider. While I was unable to get more than a general positive feeling about the students' perceptions of the teachers, I was able to at least glean some information regarding how teachers perceived students. This will provide some important insights into why teachers act in the ways that they do with their students in the classroom.

Each of the teachers expressed ideas in terms of challenges associated in teaching language learners. Some, like Maggie, were focused on what they could do to encourage more growth and language use among her students. Others, like Camilla, were challenged by the limits she felt were placed on her goals through her students' inability to perform in activities in which she had been successful with students who used more English. These perceptions of the abilities of their students guided the decisions made by the teachers determining the kinds of activities they would do in their classes.

Martina. Martina has the perception that her students are not used to using technology. She believed that many of her students just recently came from countries (maybe not in the cities, but from rural areas) where they would not have had access to such technology. So, her students did not see the iPads as something educational at first, but more as something that could be entertaining.

She also sometimes perceived students as barriers. There are challenges associated with teaching a diverse group of students, and a teacher rarely gets students who need to develop the exact same skills. One of Martina's concerns was working with students who were placed in a particular class. She spoke as if she was expecting the student(s) to be moved to another teacher; as if they could change their class "level" –

probably to her other group of students. Still, it is important to notice that she believed the student in question was a barrier to moving her whole class forward. As she says:

They moved her in my class three weeks ago, and I told them she shouldn't be in my class. She should be in the lower level class, because she doesn't understand anything.... The other one from the beginning of the year – she puts in a lot of effort, she's quiet and slower – but the other one she's not interested in learning, and she's very low [language] level. It'd be easier if she was in the other class, because these kids have been with me from the beginning and they know the routine and they know the structure, and they move forward. So, her and the one boy, who we've been trying to test for SPED (because he can't read or write) since the beginning of the year. They're the ones who I say slow me down in class, or cause that kind of stumbling stone or wrench, because they're either not on task or can't do it.... I've asked, and I'll ask again for them to be in the other class, because the other class, I can slow it down, or structure it.

(Post observation interview, 4/25/14)

While she felt that these students represented a barrier to what she could do with her class, that was perhaps because in this higher level group she wanted to give them some freedom to make choices, at the times when she felt choices were appropriate.

At a later time Martina discussed how her students struggle with the content of the course. In this situation she was talking about her students with less English language use. Below, she explained how she guided them to develop their skill with a particular

application. She said they did not completely understand what they were doing, although she was confident that they would understand the next time:

Some of them were absent like the pair up here. So they didn't know what each icon meant. But if they were to do it again, I know they would have less [sic] questions because now it has been... two times. (Post observation interview, 4/25/2013)

Later in the same interview, she talked about how students struggled with understanding the content, even in their own language.

The content out there is not accessible to them, even in my last class (with higher language use students). One of the boys – because tonsil, was not on the... body, he couldn't find the function of tonsil. So he's looking it up in Spanish, “¿Qué es amígdala?” So I helped him on *Google* find out what it was. So... I know that the content is above their head. (Post observation interview, 4/25/2013)

The comment above was interesting, because Martina spoke both about the struggles the students had with the content, but also mentioned the success that the student had in finding out what a tonsil was. Her focus was on how the student was unable to understand either the word 'tonsil' in English or the Spanish word 'amígdala'. Still, it seems the content, once she found an appropriate site to explain it, was not beyond the student's ability to understand. And while this was helpful, she did not use the opportunity to show the student how to find this on their own. So, she was underestimating her students here, their abilities to develop knowledge through multiple

languages and modalities, and, perhaps, her role as a teacher to teach them the content of ‘tonsil’ or ‘amígdala’.

Still, Martina still believed in students’ abilities to learn the content, she just doubted how the lower language use class would be able to express themselves when they “presented” on a topic. She did not believe that her students were “stupid” she had faith in their ability to learn, despite the challenges some of them presented. She knew that they understood the concepts in Spanish, but struggled with helping them present in English. As she said:

But in this class, the challenge will be... how will they present. The other [higher use] class can write a paragraph, or a couple of paragraphs, and they can kind of find the information for themselves. This class can’t, because it is not language accessible. If it were in their own language they could – it’s not like they’re not smart – they just can’t access it. (Post observation interview, 4/25/14)

It is important to note that Martina was making the distinction here between what they could do, and how their language use was limiting them. And while she was there ostensibly to teach them to use the language in this science class, she struggled to give them the opportunities to learn the content in their second language.

In general, Martina was looking for ways for learners to be successful. In this next segment she told of a small success her students had, which was of very limited language use. They copied text from a website to a production application. From her description I assume that means that they did not do a copy/paste which would have been completely meaningless to the students in their language use. Still, the students were

only, apparently, tasked with transcribing text from where they read it onto another document. As she said:

So I know the task in some ways, was... just a copy task, or whatever.

But, it still gave them pride that “Wow, I accomplished this, I did it all in English I managed the site, I know what the icons are. And I finished it.”

I think that was good. And that helped them. (Post observation interview, 4/25/14)

Perhaps this was an instance of lowered expectations, but Martina felt good that she was able to give the students an activity in which they could be successful. She compared this to her more proficient group, who would have had to process and write about what they learned on the site. It is appropriate to keep in mind that students with different use levels will not be able to use the language in the same way. Still, a ‘copy task’ probably does not show the level of ability that the lower proficient students are capable of.

As another example of this, a few days later Martina gave students a review activity during their English class (again the lower use class), where she had them practice for an upcoming quiz. They repeated as a group, “this is a...” with specific classroom objects (book, eraser, etc.). The students also wrote the phrases on their iPads, one phrase per ‘slide’. She spoke afterwards about how she was “walking them through” the activity so that they would be prepared for an upcoming test, presumably on forming these kinds of phrases.

From her first lesson, described in some detail above, through her classes, Martina guided her classes through learning activities in a highly structured way. But she felt that by starting out this way, she could provoke further independence in her students by the

end of the year. She believed that she was successful in this, with both groups of students. As she said at the end of the year:

So it was a building process for me. I think by the end we had exposed ourselves to quite a bit. And then the kids were becoming more independent... And the end too, we had a whole new class of 20 kids who hadn't been here except for a month or 20 days. So was that class independent, probably not. Except for *Educreations*, and maybe *InstaGrok*. But I guess that's a step since they just came to the country.

(Final interview, 6/11/14)

Maggie. Like Martina, Maggie struggled with the interaction between the different levels of students, but she did not talk about it as a barrier, but more like a challenge. And this was on a day when her two different groups of students were merged together without her knowing it was happening that day.

So we pushed a bunch of those [lower language use students/newcomers] into the other section, which had been like a beginner's sections. So those students are beginner students. And some of them are really high, like could be mainstreamed. And some of them are really low. And before they were really high and ready for mainstream. So, I had a much wider mix of students than I did before. (Post observation interview, 3/24/14)

Maggie is clearly struggling to come to terms with what happened in her class, and what she was going to do (or what she did), but she did not talk as if this was a barrier. She mentions that she had a "wider mix" of students, implying she knew that students were at

different places in each group before, and the only difference here is that there is more diversity in her class (in terms of language use) than there had been before the merger.

However, the class I observed was the more proficient of the two classes that Maggie works with. Maggie and Martina shared both classes which Martina taught (Maggie taught them both social studies). Maggie also taught two classes of “beginner” ESOL, which is a higher proficiency level than the two classes they shared. I did not get to see Maggie work with the lowest level students, because she was not comfortable with my observing her at first, and later we did not have time.

Later, Maggie explained her choices in using the iPads for her students in a class. Again, this was her highest language use (‘beginner’) class, so she was comfortable with them working productively. Her concern was with mechanics, and in order for them to improve in this area she felt they needed to practice writing productively. Here she explained her rationale:

It’s good that they did it on the iPad, cause they often don’t get a lot of practice word processing. So, any kind of typing that they do on the iPad, where they have to follow certain conventions, is actually a useful experience, because they have to type papers and all this... they’re not using the capital letters, or punctuation, or anything. So, its fine to have them type, and then find errors. I think that’s good practice. (Post observation interview, 4/9/14)

Maggie also seemed to understand her students’ needs to have activities which were focused and not open-ended. She spoke about this in terms of how they did research. All of the activities I observed in both language use levels of classes involved

the students in some way with research. In the first class, they had been doing research on the New World explorers, including Christopher Columbus. The second project the students did was research on mysterious beings, like Bigfoot, which was a beginning step to videos they subsequently created on their topic.

Maggie felt that if the students were forced to look for specific things, either to answer specific questions or because they needed to tell about the characteristics of a creature (i.e., habitat, eating habits, etc.), then they would be more successful, at least at this stage. As she said:

If they're just doing research, they have a hard time with that. They have a hard time with sustained focus, when doing research, if you ask them to find answers, or find information, about a subject. If they have something like a project that they're doing, then I think it's easier for them to focus.

(Final interview, 6/12/14)

She showed an understanding for the needs of her students and used it to guide her instruction, hopefully giving her students a more successful experience.

Here is another example of the way Maggie used this knowledge of her students to guide her teaching:

For example in my social studies class, when we were studying the American Revolution. One of the things we did at the very beginning of the unit was to [use] independence and revolution both of those [to] create a personal definition. So, I had them work in groups to say what independence and revolution mean to you and... [they] have to present... [their] findings basically. (Final interview, 6/12/14)

As a way of presenting, she gave them a choice between a poster, a skit or an iPad presentation. Those that chose the latter, she felt were more focused in their activity, because the iPad allowed them to better express their own ideas.

Camilla. Camilla had a strongly critical perspective of not only what her students were doing, and how she was supporting them, but she also disapproved of what she was being forced to do by the school and the school system. She had a considerable amount of agency, through not only her experience, but the roles that she had played in the past regarding the iPads. She was a model teacher for iPad use, and she made clear throughout the study period that she was not concerned about having lessons which model iPad use just because someone was watching. It made it really interesting to observe her.

Still, Camilla spoke about challenges she had with regard to teaching her students. She said that she tried to get her students to do a lot of projects, and I observed several kinds of projects in the classes I saw. Nonetheless, she was always concerned about her students' language use, because she had not worked with students who used so little English previously. In my initial interview with her, she described how she struggled in supporting a student who had very limited language use in their project. She explained it this way:

I have an eighth grader who can copy letters. And when you ask him to write something on his own, [he] can't do a lick of it. But he can copy real [sic] well. It also takes him five minutes to write down "no homework," because he is still on his basic handwriting. So that's where, to me..., for his project, when we were doing the project in *Keynote*.

“Can you find pictures to match the definition and can you get the definition.” Then after he got that done, I was worrying about him putting the sentences “I see” All I wanted (him) to do was “I see trees,” fine, because that was the language level he was at. I couldn’t get him just to get the content down, he was worried about writing the definitions, so finally I was “just get the words or the pictures or...” I think breaking things down is important. (Initial interview, 1/30/14)

Camilla was concerned with not limiting what a student could do, but allowing them to produce language at the level that they are able to within the project. A student who spent several minutes just writing one word, was still able to do a project in her science class, through gathering pictures on a topic and writing down what he was able to see. Camilla may have limited what he wanted to do, because he was trying to write down a definition (probably what other students were doing), but she was trying to break it down into components, getting him to describe what was in the picture to show his understanding. Perhaps she was putting limits on his language use through her artificial constraints, but she also wanted him to complete something in a time frame where other students were able to do so much more.

Like other teachers, Camilla struggled with the language use of her students, and this seemed most prevalent in those teachers who were also attempting to teach some content which was dependent on the language. Here she described how challenging it was to work with “ESOL students”

But that’s where I think I struggle too, how much do I want to do up front. I think modeling is so important for ESOL students, and it’s hard because

it's my first year, you know, teaching math, or teaching science fully.

[The difficulty] is having all the examples ready to show them. So, with this project, I wish I had a *Popplet* example just so they could see it, so they could get the picture in their mind. And I didn't. Now, I have lots of students' work, so next year it should be easier when I do this project, and hopefully it'll take less time, because they've got those references. Again, you've got the same problem, when they're modeling or showing the examples, with ESOL students there's a lot of copying. (Initial interview, 1/30/14)

In this statement, Camilla was describing some of the challenges she had working with her students, but she used it to drive her instruction. Her students had difficulties understanding directions, so she provided them with a model which allowed them to see an example of what they needed to do. And when she talked of copying, she was speaking about that in terms of what students would need to do, although it did not seem to be the words in the project but the form that they were copying. And perhaps there was an underlying challenge in trying to prevent them from copying too much, which she seemed to imply. There were many times she tried to get her students to move away from 'crutches', like *Google Translate*, and toward using their knowledge of English to understand. Having a model would probably have provided a different challenge for her learners.

Still, Camilla had varied expectations for her students, depending on the amount of time that they had been in the country and exposed to English. She wanted all of her students to participate in some way, but had higher expectations for those students who

had been in the country longer. As she said, they were all ‘newcomers’, but some were able to do more with their new language than others:

They’re all considered newcomers, [but] there are newcomers who have been here for almost a year and I’m trying to give them more higher order thinking skills. So I’m gonna have them do comparison, and recall (not just facts, but recall what they already knew about something) and compare it to something else. Whereas, my newest students, some of them who have been here less than a month, a couple of them have only been here a week.... We talked about the maps that found, like a red shaded region, “so where is this found?” They would walk up and point to a shape on the map, the red shaded area. So just [to] try to get [it] so that they’re... participating... at their level. (Post observation interview, 5/8/14)

Camilla tried to give students things at their level, but was not afraid of motivating them to stretch, when she felt it was appropriate, or to test to see what they could do. She explained about this in a discussion about a student who was labeled as illiterate, a description which she began to doubt. She described her thought processes this way, in speaking about working with copy and pasting text:

The only one who did that [copied and pasted] was that girl Morgan who was pretty much illiterate; who was looking for the key words. She would ask me “is this sentence ok” and I would say “yes” and [at] one point... [in] the life cycle [project], she had the mosquito, and it has four different stages, and so I wrote four stages, and put the first letter [of each stage],

and she had to look in the paragraph for the word. And she looked at me, and I said perfect. And that was the only part of her paper that wasn't directly copied sentence form. But I was curious to see if she could do that, and she got it. So, it was interesting because, you'd think somebody who was illiterate couldn't scan and search, so I think her label of being illiterate is not exactly true. I do know that she has interrupted education, so maybe it is not so much illiterate as the interrupted education. (Post observation interview, 5/29/14)

One of the activities Camilla did with her students was providing them with instructional videos through the web page/application *BrainPop*, which quizzed the students on a video (see Appendix A), sometimes in Spanish. She was not, however, successful in finding students who would look for the Spanish meaning themselves. She did not know why. It provided some additional insights into her understanding of her students. She said:

So, I have not found kids who will self-initialize the search. I have to tell them what it is in Spanish. They won't go "oh, life cycle stars, let me figure what that is in Spanish, and search for it." That's something interesting that I've found this year, there's like a learned helplessness. They want me to tell them what the title is in Spanish. Even though I've shown them, where [they] can look at the icon, go to the content area, go to the specific content. They want me to tell them the title. And I'm not sure if its because they don't know how to spell or write in their own language, [or] maybe they don't know how to type it out. That might be

the problem. I haven't figured it out. Because, even my kids who are very literate in Spanish want me to tell them what the topic is. (Post observation interview, 3/14/14)

Clearly Camilla understood that her students are literate in their home language. So, she knew that they are capable of reading and writing things in their own language. But she was not sure why they would not attempt to find something about a topic they already knew in Spanish. She showed a bit of her frustration with the “learned helplessness” in terms of her students being dependent on certain tools, their peers or the teacher (she mentioned several times where some students got many requests for help from their peers). This was an example of what Tsui (2009b) would call problematizing the routine, where Camilla was looking at how her students were interacting with her, their peers and resources and noticing there was a pattern to how they chose the path of least effort to get to the answers they needed, which did not always produce the most effective results.

I found Camilla's use of the phrase “learned helplessness” worth further exploration, because it seemed to be a judgmental term. She explained the term further, which she apparently used when discussing this kind of challenge, with some of her students. She clarified her idea through the use of another example:

I use that with the ESOL students who always [look for support]. Like early this morning, Martin and Ramon, they have a little bit of learned helplessness, where they won't self-initialize. They're motivated and they want to learn, but they want to check to make sure every answer is correct. They won't try on their own and continue to work. They've learned to always raise their hand and ask for help. And I [say], “you've got it, keep

going, go.” Or, I [say] “why, why is this correct, you know the answer, good job.” But they’re constantly raising their hand in class. “Is this right, is this what I’m supposed to be doing, does this look good?” But I think that’s because another class, possibly other classes, if you don’t raise your hand, if you’re not sure raise your hand, where the teacher’s just constantly coming by to check on them. So they haven’t learned the independence to take risks, or its ok to have a wrong answer. (Post observation interview, 3/14/14)

Camilla was not talking as much about challenges with the language use of her students (although she does mention that); she discussed other challenges students had with trying to learn, perhaps related to their ability to use English. However, her focus was not on their ability, but more with their confidence in their ability to learn the language. She was trying to give the students agency to take control of their learning process. She was a bit frustrated with her lack of success in some instances, but she was not frustrated so much by their lack of language use.

Another challenge with which Camilla struggled was the way students used *Google Translate*. I noticed the use in one of my observations, and asked her about it. She expressed her frustration with its overuse, because it was not accurate at the sentence level and was not something that students can use on tests. If students overuse it then they are using a resource which is useful *to them*, in some way, immediately, but not really useful *for them*, when they need it on state mandated tests. As she stated:

I’m struggling with the kids... [that] have formed a habit of translating back to their native language. So they’re not necessarily using the iPad to

look up their [words] - they're going straight to *Google Translate*, taking the time to type the entire question into *Google Translate* and then translating it. And sometimes it translates well, sometimes not so well.

But my thing is I want [them] to type the word that [they] don't understand or know, and figure out what part of the question means.

Because, when it comes to testing, they don't get to use the iPad. I really want them to understand, you get to use a dictionary, you don't get use an iPad. And just trying to draw a line in the sand.... Or... instead of trying to say an answer in English, they type the whole answer in Spanish, hit the translate button, and then write the English that comes across. So I'm really trying to get them to produce it on their own [language]. (Post observation interview, 5/8/14)

Still, Camilla continued to think about their language use, and how that affected the kinds of projects the students would complete. She did not resort to copying or creating rote activities, but she limited the minimum requirements for the process. As she explained:

I only required three math sentences [and] five pictures. Because in the past, it takes us four or five days to finish a project, and I just wanted this to be a basic assessment, not an intense or in-depth [one]. So I want them to create something, but I also want to keep it so I can keep moving on, and not add more days. (Post observation interview, 3/21/14)

One aspect that Camilla considered with new students is their ability to use the iPad. Students from other countries may not have had any experience with mobile touch

screen devices, or they may have had a lot. It depends on their personal technological background, which would not come in the reports that teachers receive. At one point, Camilla discussed a few new students that she had, and noted that some were well able to take on the iPads and use them with comfort while others needed more support.

Two of them [new students] seemed quite comfortable with the iPads.

Two of them were a little bit hesitant. So, I can't be able to necessarily say that they're comfortable with the iPads, I just need to give a little more direction on the iPad, to break it down break it down a little further. (Post observation interview, 3/21/14)

Camilla also thought about these students when creating new assignments for the whole class. She did not change her requirements by level so much as the minimum she is set based on her expectations for the students with the least language use in the class. For one particular project, she expressed it like this, "how much do we want, and we [her co-teacher and herself] thought of [Dianna], and our new students. So let's do three, they can always do more, but three is the minimum that they have to get done" (Post observation interview, 3/21/14).

Another interesting aspect came from the use of *BrainPop*, which as a video instruction program with a quiz afterwards, could provide the 'lesson' in any language that it has been made in. And there were many videos that Camilla used in both English and Spanish. She had made the decision to allow her students to decide when they were ready to use the English videos, and they self-selected for that. As she said:

I think that, at a certain point..., I want them to make that self-choice....

"I know enough, I want to do it in English." Jenny, she has very little

English [and] never wants to speak in English. And yet with the iPad with *BrainPop*, she wants to do it in English. Now she is one who is a clear example. Her scores are always 90-100 [did not specify, but I suspect in Spanish]. (Post observation interview, 3/21/14)

Camilla had a diverse level of expectations for her students, and her challenges this year were compounded by working in a content area she had not worked with before, and working with a level language use that she had not worked with before. Still, she kept her expectations high, and had her students create different kinds of projects which were within their zone of proximal development, while still trying to challenge them to produce language as much as possible. She also struggled with different ways to use technology, even though she was considered by all in the study who knew her as an expert in using technology in the classroom. Her struggles indicated a tendency to problematize issues which other teachers may not have dealt with in the depth she did. This understanding came from her willingness to discuss her thoughts at this depth, which other teachers were reluctant to do.

Peter. Peter had an interesting contradiction with his initial assessments of his students' abilities to use technology. He discussed how they had a low level of English language use and technology use. Then he contradicted the last bit by saying that these kids grew up with technology. First he said, "This year I have kind of a low group, and some of them have not been exposed to a lot of technology yet." Later he said, "These kids are growing up with iPhones and iPads and those kinds of Internet Facebook, Twitter, and they all know how to use it, so why not let them use the iPads" (Initial interview, 1/31/13). When I spoke to him after his first observation, he returned to the

idea that his students did not have access to technology. He also expanded by discussing their literacy skills as well, “They haven’t had any exposure to the technology. And one of them is almost completely illiterate. The other two are semi-literate. So they find it difficult to use the iPad, for the typing and all of these things” (Post observation interview, 3/14/13).

Later, I asked him about his students’ responsiveness, so he used the word “responsive” repeatedly in his reply. However, in the process we got a little more insight into what he thought about his students’ abilities, which again he used the term “low” in describing their academic ability. He said:

The majority of them are responsive, the majority are always responsive... even though academically..., sixty percent of them are kind of low. But they are motivated to learn, except for maybe, Sam..., those two, [and] in my other class, about three of them. That’s it out of thirty six. The rest, even if they don’t know they would ask and try and do the work or talk to the ones who know how to do it, to help. (Post observation interview, 5/8/13)

This excerpt was interesting in that Peter spoke about his students as struggling academically, which of course would be a challenge when learning in a second language which you use very little. But then he told how the majority of his students would try and that they were “motivated” to learn. He started by describing their challenges and tried to pivot to using their motivation and “trying” as a positive aspect to their learning process.

A lot of Peter’s comments about his students focused on challenging students, and challenges with students’ literacy and writing skills. Some of this was at least in part

because of my questions, pointing out the challenges in his class, although I did this to some extent with all of the teachers I observed. Peter however, kept coming back to talking about things the students cannot do (like write – i.e., illiterate) rather than things that they could do, other than try. He did mention that the students were used to the process he had put in place, and they were able to use the iPads actively in the class. He also spoke about how they could ‘support’ one another, with, for example, students who have more literacy skills allowing other student to copy their work. Peter also believed that the iPad made work easier to read, because they did not have to write it with a pen and paper.

It [the iPad] helps in the sense that they have it and they can edit easily. And when you’re helping, instead of looking at a book and trying to figure out what they wrote, when you type on an iPad its clear. So if they have to help each other its easy. They just look at it and copy it.... Some of them their handwriting is terrible, some of them can barely write, but they can copy from somebody else. Because I have a couple of kids who are, very [Il]literate, so sometimes I allow them to copy [not sure if he was talking about the kids who were being copied, or doing the copying].

(Final interview, 6/4/13)

Kinds of supports

The typical kinds of supports for the use of technology in any situation include technological and/or infrastructure support as well as intellectual support in terms of knowledge in to how to use the iPads as well as how best to employ them as teaching instruments within the classroom. Generally speaking, for the use of technology in the

classroom and TPACK, intellectual support is very important. But without the infrastructure, other forms of knowledge – e.g., knowledge developed through practice – could not be developed.

Technological support. The first kind of support which is provided is the technology itself and the infrastructure to run it. The technology includes carts to charge the iPads, locations to store them, wireless connection to the Internet so that the iPads can be used for both local and network functions, as well as making sure that the iPads have all the software needed and installed and are functioning properly in the network. As a part of the support structure, there should be a process to replace lost, stolen or damaged equipment. At the beginning of the year, both schools were in their third year of the iPad project, and most of the iPads were in their third year of service.

The iPads themselves. The iPads used in the study were “iPad 2s”, which were created to run iOS 5, although they were designated by Apple to be able to run iOS 7. The later operating system for the iPads was the OS released at the beginning of the school year starting in the Fall of 2013. There were sufficient numbers of the iPads for use at the beginning of the year for all the students in the school. However, as the school population grew, that number became more constrained. This growth was especially significant in the ELL population. By the end of the school year, both schools were challenged to provide enough iPads for their students. This situation led to increased barriers to the use of iPads in the classroom, especially when the teacher was outside the building, and challenges with relationships because teachers could no longer have iPads without getting permission from another teacher. There were also situations where students did not have access to iPads, when most of their classmates did, causing teachers

to have to plan for both situations in the same class: students using iPads and students without iPads.

For example, the lack of sufficient iPads presented Martina with a dilemma: keep the iPads for her own instructional purposes or allow Maggie to use them with her class. Martina stated that this uncertainty added to the challenging of planning classes all the time because they never knew if the other teacher would be using the iPads. Maggie was especially challenged by this, because she seemed to use them less because of her limited access, and then, when she wanted to use them, could not guarantee getting access.

To complicate matters, Martina had the students who shared the iPads all day long, so she could keep them from both teachers with whom she shared teaching these students all day. Her fifth mod (period) students had class at the same time as the other group of newcomers with whom Maggie worked in their social studies class. Also, Martina's third mod class met at the same time that her fifth mod students were with Maggie. The schedule for these students was two mods with Martina, one with Maggie, and a third teacher had a fourth mod for math.

Martina expressed how she felt about denying Maggie the use of the iPads. She stated: "I feel bad... [because] yesterday, when they're doing this research for this project, that I just... couldn't give the iPads to [Maggie]. But that's the first time I've ever said no" (Post-observation interview, 4/25/14). Martina was concerned about her professional relationship with Maggie and felt bad because she kept the iPads from Maggie, but she did it anyway because she felt her project was too important to let them go. It shows how Martina, who was in first year in the building, though a more

experienced teacher, had the ability to deny them to Maggie, who was in her second year in the building, but outside in a temporary classroom.

Peter and Camilla did not have such a structured plan. They had several students who had lost the privilege of using the iPads for the remainder of the year. This situation allowed them the opportunity of continuing to work with iPads with all of their classes, even though some students did not have them. Camilla discussed ways in which she tried to get the number of available iPads to support more of her students, which included sharing. She eventually gave up on this idea for the less technological option of giving paper assignments to those students who did not have iPads. She was very frustrated by having to double plan: “It sucks, because, we’re constantly going, ‘Ok, we found something great.’ And then... sometimes you can just print it off the web.... I feel like sometimes I’m planning two lessons” (Post-observation interview, 5/13/14). She did try to modify her instruction, allowing students to share iPads rather than having two kinds of work but this was not successful. She said:

We [(she and her co-teacher)] tried last week having kids share iPads. And, I don’t know if it was because it was sharing, and it was specific to math and science that they didn’t want to do that, but they wouldn’t communicate with each other. One kid would just take the iPad and do the work. So there was no collaboration. So then we tried, the next day, trying to do, “ok, well, you have to do... you have it for 10 minutes, and the next person has it for 10 minutes, but you have to communicate with each other.” The interesting thing, the kids will share with the iPads all the time. But then I ask them to share when they’re working on an

assignment [and] they're not talking. No talking in Spanish, no talking in English – just no communication. (Post-observation interview, 5/13/14)

The low number of iPads was a hindrance for three of the teachers in the study. Peter, however, seemed unaffected. Like Camilla he just had students do without, and since they were sharing iPads, the students who did without, did without in both classes. However, this did not present Peter with a challenge for planning, because most of the work students did on the iPads could be easily done on paper (answering questions from the book, responding to multiple choice items or using a graphic organizer to plan writing). His class did not change when the iPads were removed from some students, just his grading for those students whose papers he looked at and some time on his part to grade.

Martina also complained one time about how the carts were not exactly designed for the numbers of iPads that had been placed in them, and she had to make arrangements to make sure that all iPads were plugged in at the end of the day. Again, most of the time Martina and Peter seemed to have iPads for all students, most of the time the iPads were functional, and most of the time they were reasonably easy to use. However, the number of iPads in the cart made it more challenging to make sure that they were all plugged in.

Physical maintenance of the iPads. For the most part, every time that I went in to observe iPads use in the classroom they functioned normally. I only came across one instance where the iPad's functionality was a problem. In one class, when I was observing Martina, one of her students' iPads started running out of power. As a simple solution, she had to move me from where I was sitting next to a wall outlet so she could plug the iPad into the wall while the student used it. The reason for this challenge was

that Martina had not been there the day before, and some of the iPads had not been plugged into the carts properly. Although I only observed it the one time, she talked about it as if it happened more often, and that some other teachers may have had more challenges with iPad functionality, but it did not seem to faze her too much.

Another challenge in terms of physical maintenance was the replacement of iPads. When iPads were broken, or the software was locked up for some reason, teachers either had to take them to someone in the building to attempt to fix the software problem, take them to Apple to fix the software problem, or take them to Apple to get them replaced. Apple charges a fee for the replacement of the iPad with a refurbished model. The process of replacing an iPad also took a few days to a several weeks. This process usually indicated that a teacher and/or administrator would hold the damaged iPads, wait until there were enough units that needed to be replaced or they had time to replace them, or felt there was sufficient need to do it.

Camilla talked about how students were “resetting” their iPads and the process to replace them. She suggested that students might do this during “enrichment time,” a time when students were working on activities which were not related to a specific class, which was meant to assist students to perform better on state tests. Further challenging this issue, students could lock the teachers out of being able to fix the iPads after they had been reset by putting their own passcode in to lock the teachers out. Also, it might have been a student different from the one to whom the iPad was assigned who modified the passcode so a student might not know the code or was unwilling to disclose it. In the end, this was yet another example of an iPad which needed to be repaired or replaced. Either way, if an iPad was damaged or inaccessible, someone had to repair or replace it.

Finally, the software that was installed on the iPads was sometimes problematic. At the beginning of the school year, the iPads in Gran Torino Middle School had been upgraded to iOS 7. Once the upgrade was complete, however, there were challenges with setting up the devices so that they would connect automatically to the wireless infrastructure of the building. Upgrading the iPads had apparently been a fairly easy process the year before but, between teaching classes and failed attempts at setup, it was well past October before the devices in the building were ready for the teachers to use.

Also, there were instances in both schools when the software that the teachers wanted to use was not available on the iPads. Camilla used the practice of polling her students to see what was installed on their iPads, prior to attempting to use an application. Martina had wanted to use *The Rosetta Stone* (see Appendix A) almost from the beginning of the school year, but getting it set up and installed on her students' iPads took literally until the last week of their use. The students may have only gotten to use the software once or twice before their teachers had to turn them in.

Martina talks about some of the challenges with getting *The Rosetta Stone* to work on the iPads working in this way in a post-observation interview on May 22nd:

Rosetta Stone I've always known about, because I'm a language studier. I've never used it myself though. And then, in the fall, I was told I was supposed to pilot the group, but we had multiple, multiple, issues with getting it to work. Or people not helping me getting it to work, which was frustrating because it was really simple once it was there. So, it wasn't until November/December that we could access it, but then, people couldn't help me log on. It wasn't until recently [that we got it working].

This extended delay kept Martina from using software which she had experience working with on other platforms, expecting that it would assist her students. The continual delays deprived the students of the opportunity to use the software, which they did not receive until April, not long before the iPads were removed from class.

Maggie also had a challenge with getting the camera turned on. She had decided to use the iPads for recording video, which was a project that she had wanted to do starting in March. I observed her class for the planning stage just prior to the use of the iPads for recording (on April 9th) and then again when they actually did the recording (on May 20th). These two classes were almost two months apart, and much of the delay was because she was trying to get the cameras turned on. She described it this way.

Well, they [technical assistance] didn't get the cameras turned on until the day before, or two days before. So, we couldn't do the filming or anything until then. So they [the students] were doing some research and they were writing a research paper in between this time of the project.

And also doing other things that we had to do. But, in terms of the filming, we couldn't do it..., until their cameras got turned on.... (Post-observation interview, 6/04/14)

Again, a technical delay caused students to not be able to use the iPads for their intended purpose. The delay almost prevented one group of students from recording their project, and did prevent a second class from doing the same. The iPads were taken away prior to the second class, on the same day the first class recorded their projects.

Network support. In general, there were typically no problems with network support. But when there were problems, they were severe. For example, the network

issues at Gran Torino with the updated iOS prevented Martina and Maggie from using their iPads until October or November. But there were also challenges with Maggie's network in general.

Maggie was out in a temporary building, outside of the school. She did not have a wireless connection in her room, but had to use the connection that came from the building, and Maggie's external temporary was not the closest to the building. This networking situation provided problems with getting a reliable wireless network, especially when she had a lot of students using it and/or the students were streaming video or audio over the network.

Maggie was spending her second year in this temporary building, and she was already concerned about the situation in her initial interview. In a post-observation interview on April 8th she shared the following:

I tried to use the iPads as much as possible, but the Internet is an ongoing challenge. Because, you know, the Internet signal here is very weak, and so when we use the iPad for anything Internet dependent, you know the students [would say] "oh, the WiFi is not working, the WiFi is too slow, I don't have WiFi..." So it... eats up a lot of instructional time, trying to deal with those issues. Going to other rooms is not always feasible.

Ideally, I would like to have another place to take them. Well, ideally, ideally, they would just have WiFi.

From her description you can see that whenever she tried to use the Internet, students would end up being distracted from their work because of challenges with what should have been an automatic connection to the Internet. This distraction would continue to

affect Maggie, who had to visit each student and remind them to keep trying to connect – taking her away from working with other students. The Internet challenge for Maggie proved to be significant through the year I observed her and may have contributed to the limited number of times I observed her class and/or she used the iPads in general. Usually, however, when the teachers were in the main school building, there was no problem with accessing the Internet with the iPads.

Software. I have already spoken briefly about some aspects of software support, for example talking about the operating system and the installation of paid software like Rosetta Stone. However, most of the software that the teachers used was not ‘paid’ software, but free versions of paid software, or (rarely) just free software. Getting paid software was a challenge, because students would have to buy it for each iPad that it was used on. For example, the Popplet lite version is free, but the paid version is \$4.99. This is not much for an individual, but when you have to purchase the app for every iPad, then it becomes a bit more expensive. Additionally, there is the challenge is determining which iPads should get a particular app. Should it be purchased for the whole school? Should you purchase it just for one classroom or group of students? Since the apps are loaded on via a computer which they sync to, you would have to specify which computers and, hence, which iPads would receive the application.

Maggie complained about this when she attempted to request an application for her students’ iPads and was refused. Martina tried to avoid the system, when she attempted to get her students to use her account for her book reader (the software is free, but the books cost money). They all attempted to access a book using her account at the same time, and almost all or all were blocked.

This provided another challenge, in that the free or “lite” versions were limited in some ways. For *Educreations Interactive*, students could only have one project at a time, so they could not start a second project while they were working on a first project. Martina, who used this the most, could coordinate the English and science projects so that the students could finish one before starting on a new project, but if another teacher was using it with the same students, they might accidentally wipe out work that was created for another class.

Intellectual support provided at the schools. Both of the schools provided different kinds of intellectual support throughout the year and also during the summer. Some of this support was in the form of organized professional development such as workshops offered by the district, Apple, or other organizations. There were also more informal supports provided by peers, who would provide suggestions and/or give software ideas.

Schools. Each of the schools was a middle school (grades 6-8) in Rollings County Public Schools, which is large public school system in a mid-Atlantic state. The two schools which I investigated were very similar in terms of the school population. However, the perspectives of the principals in terms of supporting their English language learners was very different. They also had very different ways of dealing with the research and the use of technology in their schools.

Gran Torino Middle School. Gran Torino Middle School is located in the suburbs of a major metropolitan area in a middle Atlantic state (see Chapter 3 for details). During the year I was studying Gran Torino Middle School, there were four ESOL teachers at the school. Three of the teachers were working with newcomer students, including Martina.

While the other two teachers (Maggie and one not in the study) worked with students with more language use, Martina was the only teacher who worked exclusively with newcomer students. Newcomer students would register at the lowest level of the WiDA scale (1-entering) (WiDA, 2015), and would basically have been found to have little or no English language ability in all four language skills. Of the three teachers working with newcomers, two were in my study, Martina and Maggie.

Maverick Middle School. Maverick Middle School is also located in the suburbs of a major metropolitan area in a middle Atlantic state (see Chapter 3 for details). During the year I collected data from the school, Jonathan Traeger was the principal. Maverick Middle School had only two ESOL teachers in the school. According to Camilla, there was something of a confusion regarding the number of ESOL teachers. Some of the other teachers considered themselves to be ESOL teachers, although in consultation with the principal, he confirmed that there were only the two, Peter and Camilla. These two teachers worked only with newcomer students, the other levels of ESOL were in completely mainstream classrooms.

Mr. Traeger had decided a year or two before the year of the study that he would only provide support for the lowest level students (newcomers) within a sheltered ESOL environment. This is the reason why there are more ESOL teachers at Gran Torino, though the population is basically the same. All the other students would be in class with native English users, although they would be on an “ESOL” team. This means that ‘beginning’ ESOL students (those with a WiDA level of 2 or above) would be taught English language arts alongside native speakers. For this reason, Peter and Martina were responsible for two groups of newcomer groups. Peter taught both groups English

(ESOL) and social studies, while Camilla taught them mathematics and science. Since the two rooms were adjacent, these students spent most of their time in one of their two rooms. The classes originally started out as 6th/7th grade for one group and 8th grade for the other, but as the numbers increased, the lines which divided the grades between these two classes got blurred, and there were 7th (and probably 8th) graders in both groups.

Professional development. Professional development usually took place after school, on weekends or during the summer. However, the year before the study Maverick Middle School had instituted several different programs to support their teachers. Professional development during staff meetings and during planning days on a bi-weekly basis (Tech Thursdays), did not occur during the 2013-14 school year I observed, but Mr. Traeger, the principal, suggested that he had plans to resume it. Although it would surely have been useful for struggling teachers, it may have not been a priority because they were in their third year of the program.

Most of the teachers described some professional support. Maggie spoke about how much professional support she had prior to entering the school (support provided by the school system and by Apple). Camilla spoke about all the different kinds of technology-based trainings she had attended (Google lesson based training and Apple certified training). Martina spent a lot of her early months in the school attending different Apple trainings, which provided her information about apps for use in her science class, but not as much for working with her ELLs in her language classroom. Peter mentioned a couple of Apple sponsored trainings, on software like *iMovie*, *Notability* and *DropBox*. The key here is that all the teachers had some opportunity to become professionally trained, either through the school system, or from Apple.

Martina. Martina's technology training, for a first year teacher in an iPad school, was rather limited. The school was in the third year of the program, and it may be that much of the training had been accomplished in the previous two years, at least for the teachers who had been around since the first or second year. Still there was some training. Martina received training on using the InterWrite board. She was informed about "Apple" trainings, which were offered to teachers at the four iPad schools. These trainings provided teachers with information about how to use various iPad apps. Finally, Martina received word that she could get assistance from the technology coordinator. She described the training she got at the beginning of the school year:

This week I went to *InterWrite* training for my *InterWrite* board. A lot of schools haven't focused on how to use technology. I guess last year I was taught *Edmodo*, *ClassDojo*, and then *SmartBoards*, and I went to that technology conference.... I've been looking in[to] and went to Apple and whatever trainings have been coming up. I've been trying to go to [the trainings] so I can be ready to help my kids with [the iPads].... The Apple training showed me... the different apps the kids can use on the silver system, or math or algebra, but... then they showed the courses and collections. But people did ask at the end if they had the trainings on how the kids can self-produce. But because iTunes was a... course manager, and then *iBook Author* it can only work if you have a Mac [laptop or desktop computer], and I have a Dell. So, I'm trying to get the principal to convince my IT person to transfer it to a Mac.... So, they asked for it and

my IT person... said if I was interested in learning any more, she would offer the courses and help me. (Initial interview, 10/17/13)

Eventually, Martina found that the training in the school wasn't enough, and got involved with leading a series of afterschool sessions on using the iPad, which was sponsored by the Title I program. She and another teacher were trained by the Title I office, with the understanding that they would then offer the materials to teachers and use them to train others. Two things that are important here: 1) the school was not really providing much professional development for the new teachers during the school year, and 2) Martina was using her agency to attempt to find professional development to learn what she needed.

Maggie. Maggie had entered this school in her first placement as a newly certified TESOL teacher, in its second year of the one-to-one iPad implementation. She received training prior to teaching her first year through two different initiatives. The school provided her with the basics for using the iPad in the classroom (or perhaps just for using the iPad). She also became involved with a Title I initiative on transforming education through digital learning (TEDL), which started in the summer of 2011, and she attended in the summer of 2012 (Personal communication, 2013). She tells about her experiences this way:

[professional development was provided] through both the school level and the county level. [School] training on kind of the basics of how to use the iPad [and] then countywide, there's TEDL academy, that they do a week long of professional development course on how to integrate [technology into your] course. TEDL is... professional development that

they have on different topics in the summer that I did last year. (Initial interview, 10/09/13)

So, at least when Maggie came in as a new teacher, at the beginning of the second year of the one-to-one iPad implementation, some training was provided.

However, Maggie was not as impressed with the content of the training as she was with the chance to learn from her peers. To her, the greatest benefit was not what the presenters were sharing, but what she was able to learn while working with other teachers:

[Each workshop] was kind of a variety of presenters and topics. And most of the topics were centered on one particular product or website to show it. It would either be a feature of presenting which [I] could probably use in my classroom, or it would be a representative from the company showing you how the product worked. It might have been more useful to be thematically or content-based and so provide wide sample of things that could be used rather than in-depth with one particular product, including [information on]... if that [the software] is appropriate with students or even used [supported by the district]. You know [in] some settings, schools don't provide licenses for [software purchases]. (Initial interview, 10/09/13)

So the professional development Maggie received was not as useful as it could have been because vendors did not focus it on the needs of the teachers. They simply showed how to use the application (technological content knowledge), not how to use the application in the classroom (TPACK). So, much of what she learned was from other

professionals who had enough experience to understand how to apply this new software to a classroom situation. Also, she liked the idea of the new software, but thought she might get back to school the following fall and find that she didn't have access to that particular software or web page or that it now required money to purchase and she would be unable to use it with her students. She was also concerned that when she looked for similar software, she might not find anything in the appropriate price range.

Peter. After he came to the school, Peter said that he received “quite a number of technology workshops” from the district, over the “past couple of years”, during the time of the iPad implementation. He also said that he received technology training from the district during his time teaching and even from the ESOL office. As a result of this training, he claimed to have been prepared to use technology, although the kinds of applications (Viber and Skype) he talked about are more for personal use than teaching.

As discussed earlier, most of the classroom-based applications that Peter used were for assisting with administrative matters, like grading or ‘photocopying’. The classroom applications he used for this were *Socrative* and *Edmodo*, which provide a location to store documents for class and allow for the creation of assessments. Peter also used classroom created ‘tutors’ which allows the student to practice language use or reading while using the computer, again with the students doing most of the work. These are the most teacher-centered aspects of computer use and are not really moving toward the current ideal: online collaboration.

Camilla. Camilla had tried to get as much training as possible during the years that she had been working in Rollings County Public Schools. Like Martina, she was very interested in more professional development and used her agency to attain as much

as possible. She had had training on various different kinds of interactive whiteboards, Google applications, Apple Certified Foundations Teacher, among other things. Some of these trainings, like the whiteboards, were standard. Others, like learning how to use Google in the classroom and becoming Apple certified, went above and beyond what the typical teacher would attempt. Most of the trainings were not so much school provided professional development, but opportunities for which Camilla had requested permission, funding and substitute coverage (if it was during the school year). So while the school provided support, it was more something that she attempted with her own agency.

Camilla was really excited about using the technology, and it showed in how she talked about how she wanted every kind of training and technology that came into the school:

My first teaching job we had *Promethean Boards*, so I learned how to use those. When I switched schools, we had *SmartBoards*. When I was in the master's program, I had *SmartBoards* for my internship. Those worked really well, I was given no training on it, so I had very basic use of it, but I was able to use it in class. And here we have *InterWrite* boards, and my first year there was no training offered, but I just kind of worked as I could. And what I did, which I think is always a great way to... [learn, is] during my planning periods (when I didn't have meetings), [I would] go and observe other teachers and see how they used it. And if I didn't know how to do something, I would ask them. And I find that just beneficial because you might think of one way to use a technology, and another person uses it in completely different way. And you get the benefit of

both worlds, because your collaborating, but you're also getting to experience new things. (Initial interview, 01/30/14)

SmartBoard, *Promethean* and *InterWrite* boards are all kinds of interactive whiteboards, which hook up to computers and have projectors. Although they have similarities, they also are distinct in that they are produced by different companies with many different features. Camilla was very excited about using technology and took the opportunity to learn. But she also mentions how she sought out other teachers from which to learn. From her description, there were several teachers in the school who were comfortable with using technology, and she made good use of what they had learned about various technologies in the building. She used the school's community of practice to develop the skills she needed to use iPads in her classroom

Like Martina, Camilla also was a source of training for other teachers in the school. She had not spoken about how she became trained in the use of iPads; whenever the question came up, she talked about more general trainings which might have been provided for other teachers (maybe even taught by her), or more specific activities which she was the only one at the school attending. Still, it was interesting to hear what she had to say about the kinds of training which were provided by the school.

There hasn't always been... training, specific for every teacher, but we have provided training for iPads every year, which has helped teachers more than I can say with the *InterWrite*.... So, the one thing that I can say that has been beneficial about us using the iPads, is that we have provided training in house every year. Some of it's [a] refresher, but some it's new stuff.... (Post observation interview, 05/19/14)

Both Camilla and Martina were very interested in learning about how to use the technology, and when professional development was not provided, they sought it out on their own. Peter was not as concerned about learning anything beyond the basics and would pick up what was provided to him. Maggie was interested in what was provided, but not to the same extent that Camilla and Martina. In each instance, the training provided by the school and district influenced what kind of teachers they would become.

Peer support. One of the big ways that teachers learn about using iPads with their students is through peer support. Each of the teachers mentioned peer support for many different reasons. Maggie and Martina had to work together since they were working with the same group of students for all of Martina's class and half of Maggie's. This became even more important after they started sharing iPads between the two groups of students they taught the most. Camilla and Peter also had the same groups of students, who spent four of their five academic periods with them. Beyond this cooperation, however, there were supports each of the teachers got from colleagues, both within the school and within their team. Peter specifically mentioned Camilla as one of the people he looked to for support. Maggie said the same about Martina and her professional learning community.

Martina talked about how she canvassed her peers to find out what they were using to support reading. From this canvassing, she discovered a reading software package that had been used the previous year. She said, "all the teachers in the school use *Achieve3000* to find information text, or literary text for the kids to... read, and the kids can access it... on the iPads" (initial interview, 10/17/13). This prior experience

from her peers gave her expectations as to what she might be able to use with her students once she got iPads.

Of course, Martina helped out her peers greatly by volunteering to be trained and co-present the professional learning community (PLC) within the Gran Torino community. She and a peer attended a training sponsored by the school district and then used the same materials to create a learning community within their own school. These teachers evaluated their digital-age priorities to help the presenters target their presentation to the needs/desires of the community. They also assisted the teachers in applying “SMART” goals, i.e., goals that were specific, measurable, achievable, relevant and time-bound – which would keep the teachers focused on what they could attain during the time that they allowed themselves. While there were a lot of specific applications that they covered, the course was more about how to integrate technology with a plan (i.e., SMART integration). This use of SMART goals seems to fit in with Martina’s ideas about using technology in that she seemed through her discussions to be looking for uses which were meaningful for the students. At times she got excited about specific applications, which I saw because she would mention a session and there would be many new applications that she would be using with her students.

Technological support. Robb (2006) wrote about the notion of autonomy, teacher autonomy and self-directed learning when proposing the idea that teachers need to become more independent in their acquisition of technological knowledge regarding applications and uses for technology in the classroom. Here, Robb is encouraging developing teachers’ agency to enable them to be able to develop their own knowledge regarding the use of technology in the classroom.

Each of the teachers in this study used technological resources to expand their own knowledge regarding their TPACK of iPads in the classroom. Each had their own motivation for the use of web searches to assist them in understanding the technology they wanted to use.

Martina was in her first year of using iPads for instruction, and for this reason she looked for many different sources for assistance with her TPACK for iPads. For instance, her initial training was with apps which were shown to her at Apple trainings. After these trainings, she would go home and “play with” a particular application, or group of applications and see what she liked and did not like. Later she would search within the App Store (an application on the iPad which provides software for the end user) for items related to the content she wished to teach. This was especially true when she was teaching science classes.

Maggie also talked about learning about technology by playing with it or as she says “fiddling” with it. This was her first action when trying to learn about something. She said that she would probably, at least initially, ignore the instructions when she first used an application. She might look back at the instructions later. Of course, if she really got stuck on something she could, as she said, just “*Google* it”. For her, here at least, it seemed like she was more concerned with working with something she already had, rather than (like Martina) looking for something new. Maggie also talked about how daunting it is as a new teacher getting all these apps thrown at her:

I mean at a certain point it gets kind of overwhelming, because they just throw a lot of apps at you.... You can use this app for this and this app for that and its not necessarily easy to see how everything integrates into a

lesson.... I find that sometimes the easiest thing to do is just... try it out in class and see what the students can do with it and what they like or don't like and what the limitations of each one are. (Post observation interview, 3/24/2014)

In her comment, Maggie showed a certain hesitation to implement technology in her classroom. One of the things she mentioned about the trainings she experienced was that they were often app-based, but not always very classroom focused. She said that a lot of the time she learned more from her colleagues attending the workshop than the presenter. Her inexperience with teaching, with or without technology, made it more challenging for her to implement innovations in her lessons. However, she did not seem reluctant to allow her students to try new things, as her last sentence implied.

Peter, like Martina, seemed to use online resources to find applications. However, the kinds of applications he talked about seemed to have more to do with management than with the content he was teaching. Like Martina, he searched for items on the App Store which would be useful to him. The applications that he talked about are a scanning app, a grader and an equity stick program. In his description of his searches, he also revealed challenges he had with the applications.

For example, [I] downloaded a scanning app. I tried it once, but never used it again.... I downloaded a grader, which I used throughout the year. I also downloaded an equity stick, where you just program the kids name in. But my class changes so much, and I kind of lost track of how to add kids, so you have to create a whole new class again, so I just stopped in the middle of the year. (Final interview, 6/12/2014)

The last sentence telling how he stopped using an app which he loved, because he “lost track of how to add kids” is an interesting statement in this regard, as it shows how Peter is unwilling to expend his agency to solve a technological problem. Maggie would probably have Googled how to fix this situation, after playing with it first. Martina and Camilla would have probably done the same, though they did not talk about this. Peter did not, and told me so.

Camilla, like Martina, was often looking for resources for her students to use. However, she did not limit herself to applications – she searched in the web browser and was happy with web applications as well. She discussed how she changed searching on the computer to the iPad so she could find applications which were not Flash-based (a web browser add-on that allows for animations, which does not work on iPads) and would work on the iPad. She did occasionally talk about applications she had discovered—for instance a Tangram application she had discovered for her mathematics class. She also mentioned a teacher specific website that she used to find things, teacherspayteachers.com, though she only used “free” resources. Throughout our discussions, she did not mention learning about how to use an application through the Internet. The only teacher who did this was Maggie.

Teacher background. Teachers in this study came from varied backgrounds. The support of their previous experiences assisted the teachers in their instructional decisions in the classroom. These supports are varied because at the time of my study they had been teaching for different amounts of time, and because education programs had changed.

For instance, Peter had been teaching for about ten to fifteen years, and had considerable experience teaching. However, he did not have much experience prior to teaching in using technology (either individually or as a teacher), partly because it was not really in existence where he grew up, or in schools when he was learning to be a teacher. When I asked Peter if his university program gave him technology integration training, he responded this way: “No we did not. This was, about what, ten to fifteen years ago. No we did not” (Initial interview, 1/31/2014). Research on the teacher as learner (Freeman & Johnson, 1998, 2004), teacher identity (Attia, 2014; Johnson, 2015) and teacher beliefs (Ertmer et al., 2012; Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010) suggest that lack of technology in his experiences prior to teaching would have influenced how he taught, and his ability to use technology as a teacher.

Both Camilla and Martina had considerable experience using technology, even in their high school setting, and/or as kids. Martina went to a science and technology school, where she was expected to use technology. Camilla’s father was very involved with technology. Both came into teaching with some expectation of using it and therefore, moved to situations where they could find more classroom technology access to it. Martina even moved to Gran Torino because she wanted to learn how to use iPads.

Maggie was in quite a different situation, as she was only in her second year of teaching. She had considerable experience using technology as a student and as a part of her life. Software like *Facebook* was a regular part of her non-educational experiences, as she mentions when she discusses how she thinks about online software. Still, like the other teachers, she did not have any experience learning technology use in the classroom

from her educational experience. Maggie describes her technology teacher training in this way:

In the [teacher education] program I don't remember there being specific training on the use of technology. Most of that I kind of picked up from the mentor teachers, watching them use the interwrite board or desktop computers in the classroom. They [the teachers or education program] didn't have anything like iPads. (Initial interview, 10/9/2013)

Their experiences may account for differences as to how the teachers reacted to using technology in their classes. Although none had any educational training in using technology in teaching, most were able to acquire it after arriving in the classroom.

Experience with technology. Technological experience is important, because authors have implied that prior experience with a specific kind of technology is a strong indication that teachers will be successful in using that technology in the classroom (Egbert et al., 2002; Hegelheimer, 2006; Kessler, 2007). This is also implied by the success of digital natives versus digital immigrants (C. Jones et al., 2010; Prensky, 2001). One of the key distinctions between the four subjects in this study is their experiences with technology, and how long (in terms of their personal life experiences) they have been using it.

Martina. Martina had extensive experience with using technology in her lifetime. She described her experience as starting at a science and technology high school, where she was expected to use technology as a part of her learning. She also shared experience with working with technology in her college years. In addition, her father worked with computers when she was a child, so she had early exposure, similar to what is expected of

digital natives. She also shared that she had spent several years working with technology (though not iPads) at previous schools she had taught at. However, throughout her experiences, she shared no information regarding learning how to teach with technology during her teacher training.

When I asked about her ability with computers, Martina had this to say:

I'm a very quick learner, and I've... always been. My dad's been into computers and again I ... went to science and tech (high school), so I believe whatever's... produced or shown to me once, I can learn quickly and reproduce it. (Initial interview, 10/17/2013)

Maggie. Maggie had the most experience with technology, as she had grown up using it, or at least one would assume so from her age. She did not mention that she went to a science and technology school or that she had learned at all with technology in her classrooms. It was probably there, but quite possibly not used well. She did mention her personal comfort with technology, and through her description, showed that she had a lot of experience with computers, software and online platforms. She mentions the large companies, like Microsoft, Google and Facebook – software which other companies try to emulate when they are making their software – so if you know how to use applications from the most common applications, you will probably find it easy to transfer that knowledge to something else. She also mentions that she was not timid with her use of any kind of technology available to her in her whether she had previous experience with it or not.

When I asked her about her comfort with technology, she responded in this way:

I don't I feel like sometimes... people [feel who] are really hesitant about technology..., because there is a sense sometimes that each new piece of technology has to be learned discretely as a separate point.... I think – and I don't know if it is... [a person's] age [i.e., digital native], or... [their] exposure to [experience with] technology – is you feel like there's not [for me] necessarily an intimidation with picking up a new piece of technology; that you're going to have to learn a whole new set of rules [with new technology]; that... if it is well designed, you kind of know where things are, what its supposed to do, and you can always *Google* [it if you need to know more]. (Initial interview, 10/09/2013)

She did not share how she learned with technology in her schooling, and I did not ask about this. She did share that she had only limited experience in her teacher training with using technology in the classroom. And her training with using technology (and iPads) with students was limited to the summer TDLC and the PLC which Martina had presented. She did express concerns about using technology with her students and had challenges with control issues. She felt personally comfortable using technology, but not as comfortable with teaching with it:

In terms of what I can do, I feel pretty comfortable with them. In terms of the actual, how comfortable do I feel doing it in the class. Its always... a... mixed bag kind of or I'm of two minds, because on the one hand they like to use them. But on the other hand..., it does require more vigilance..., because they'll always be trying to go to YouTube or play a

game or something else, rather than work on their classwork. (Post observation interview, 3/24/2014)

Peter. Peter had only very limited experience using technology. He shared no experiences prior to his working as a teacher, and very few from when he worked as a teacher prior to having iPads in his classroom. At one point he mentioned the technology trainings I used to give in his school when I worked in the district, but I did not ever recall his attending them. Beyond that he only mentioned his use of technology for acquiring information or communication, and challenges he had with using iPads in the classroom.

When I asked Peter why he felt comfortable with technology, this is what he told me:

Because I've been around it for sometime.... I'm always using it, even if I just use it for a few things..., [to] read newspapers online, which I do a lot; watch soccer online, watch sports and stuff, and of course Skype.... I'm just comfortable holding these devices and doing things on them, some of the applications. I mean there are too many of them, so that's another problem. [There is always a new application] and selecting the right one for a specific lesson and so on can be a challenge sometimes. So I don't use a lot of them, but I just use a few [applications]. (Initial interview, 01/31/2014)

Camilla. Camilla had a lot of experience with technology and teaching. She previously had been a television and video production teacher. This is where she got her experience working with using technology and teaching and project-based learning. And

because her former students created language-based products using their equipment, it also prepared her for what she could do with language learning students. She has also since become both an Apple certified teacher and a Google certified teacher.

Prior to becoming a teacher, in her earlier life, she grew up with applications like Word Perfect, and because of this she became very used to using the keyboard to access controls for various things within an application (like copying and pasting, etc.). She did not become comfortable with using the mouse, and when she converted to the Apple, she needed to find out how to do things with keyboards. That eventually happened, and she is still more comfortable with using the keyboard than the mouse.

Also, she grew up in a family in which both of her parents were deaf and where there was a lot of technology in their house. And though she considers herself a digital immigrant, she had spent a lot of time working with technology as a child. Her parents had email when she was a child, and she even had email in her high school. Her dad was always willing to try out new assistive devices for the deaf, and she became aware of technology as she grew up through her early exposure to it. As she said, “I learned about all sorts of different things, and I learned to play around and experiment” (Initial interview, 01/31/2014).

Training/education in use of technology in classroom. Perhaps more important than experience using technology is experience using it within the classroom. As Maggie stated, she was comfortable with using technology for herself, but was less comfortable with teaching with it. Peter even mentioned that he was comfortable with technology, but not with the kinds of technology which are used in the classroom. As Egbert et al. (2002) indicated in their early study of training of technology, those who have the most

experience with using specific applications in a classroom-like setting, will be the most likely to continue using it in their own teaching experience. Any technology training will help, but the more training, the better.

Martina. In addition to Martina going to a science and technology school for high school, her father also was into computers. Prior to coming to Gran Torino, she had experience in using technology in her various settings and had been asked to train teachers on the use of applications like PowerPoint or Excel, as well as how to work with 'Edusoft'. Her experience working in other schools had both positive and negative aspects, as I will talk about below. Martina considered herself to be comfortable with using technology, at least using and teaching with it. However, she would not consider herself to be a programmer. During our initial interview she told me about challenges she had been having with a new setup for the iPads, and how her department had been struggling with setting up these computers to work with the school's Internet connection. Martina was unable to set them up herself. However, once this kind of set up was finished, she was fairly comfortable working with the software on a properly set up device. As she says:

I'm good at math and science and technology, so if people ask me [I can help]. I just taught the teachers how to make reports and custom groups in *Edusoft* and... I've been asked to teach people about *PowerPoint* or *Excel* or different things. So I just catch on to new technologies fast, so no I don't [think] it will be an issue. (Initial interview, 10/17/13)

Martina's statements show that she was very comfortable working with software and showing others how to use software (whether web-based like Edusoft [a student data

information system] or desktop-based like PowerPoint or Excel). This would be very useful once she started using the iPads.

Maggie. Maggie did not receive any specific training on technology from any of the course work that she received prior to being hired to work at the iPad school. She describes her training working with technology in this way:

Before I was in grad school, all the teaching I did was in... circumstances were there wasn't a lot technology – you know, free programs where we were working in someone else's classroom.... And in the Peace Corps we didn't have any kind of technology in the classroom. In the... [teacher education] program I don't remember there being specific training on the use of technology. Most of that I kind of picked up from the mentor teachers, watching them use the *InterWrite Board* or desktop computers in the classroom. They didn't have anything like iPads, though I knew the iPad program existed. (Initial interview, 10/09/13)

In addition, Maggie's experiences with technology did not include any specific training for instruction, and she did not speak about her learning experiences prior to college. However, she did use technology if only on a personal basis, prior to working in the classroom.

From this passage we can see Maggie's confidence in using any technology, at least partly because of her familiarity with other software. She explains that her belief is that if she uses new software, there should only be a small learning curve if it is well designed because it will be similar to other software in predictable ways. And if she runs

against something she cannot figure out, she will look online to find additional information i.e., 'google it'.

Maggie had some experience teaching prior to becoming certified to teach ESOL. She worked with adults in community colleges and had some teacher training prior to being a Peace Corps volunteer in public schools. Finally, prior to her first year teaching in the public schools, she went through a 15-month intensive master's certification program.

Maggie's first placement after becoming certified to teach ESOL was at Gran Torino Middle School. She had taught at Gran Torino for one year prior to the study. She was initially fairly excited to be a part of an iPad school, because she had heard something about it prior to going there. She told me about her excitement when she first heard about the possibility of working at an iPad school, "I thought, oh my gosh, that would be great, that would be so useful. I was really excited about it" (Initial interview, 10/09/13).

Peter. Peter got his initial training at a university local to his school system, with a master's degree/dual certification in Bilingual education and Special Education, "10-15 years ago". It was a two year program, which he finished in about a year because of taking extra classes and classes over the summer. During this training, he did not receive any training in the use of technology in the classroom.

Peter then had the option of teaching special education or ESOL and decided to teach ESOL because he had more of a connection with those students, being from another country himself. He explains his choice this way:

because I feel I have a connection with the kids, as an immigrant who has been here for quite some time, and relatively successful. You know, I feel that I have some kind of connection with these immigrant kids, I can help them, not only to learn the language, but to navigate the system, you know, be successful. (Initial interview, 01/31/14)

As you can see, Peter was often very concise in his answers. Here he expressed not only his reason for teaching ELLs, but his teaching philosophy as well.

Camilla. Camilla started off teaching in a different district working as a television/media production teacher. She got that job as a provisional teacher, because of need in the district, then got a degree in television and video production, and eventually got her master's certification and a job as a TESOL teacher prior to the first year of the iPad implementation at Maverick Middle School.

Her initial degree contributed to her views about how to use technology in the classroom, as well as her ideas for project-based learning; she is always thinking of projects in terms of videos being made.

I've learned how to learn a multitude of computer programs, video products and software, and... a lot of different arts/media type[s].... In teaching, I try to take almost any PD [professional development] that's offered that's technology related.... I've taken classes on *Google*. I went to the Maryland *Google* in Education summit this past summer. And that was amazing, because it wasn't so much teaching me *Google drive*, or *Google apps*, because I understand that. But [it was] teaching me how to translate it into the classroom. (Initial interview, 01/30/14)

So, Camilla's experience with technology is lengthy, and she has a lot of emphasis on training outside of school.

Summary

The data collected shows many interesting differences between the teachers' use of technology, and perhaps even some gleans into their knowledge – based on their differences in perceptions of teaching, technology, using technology and students. It also shows how different developmental aspects may support or challenge teachers as they attempt to use iPads in a language learning classroom.

The teachers' classroom experiences with iPads were examined, through a compilation of activities which they used in observed classes and through a detailed description of one of their classes. Each of their activities was evaluated with descriptive ratings based on the scale developed for the study (see Appendix K). As previously noted, the scale is based on the idea that higher levels of TPACK (technological, pedagogical and content knowledge) would be student-centered, rather than teacher-centered (Niess, 2011). The ratings showed similarly low student-centered activities; although some teachers attempted higher-rated student-centered activities than others, the differences were not large.

The kinds of activities viewed also showed differences in what they were willing to show to the researcher. Some of the teachers were more willing to allow the researcher to see every aspect of the classroom, regardless of whether there was technology, or even instruction going on at the time. Other teachers may have been more concerned about the perceptions of the researcher, and for that reason may have limited

the kinds of activities that were viewed. There is at least some sense that the activities were chosen in some case specifically for the researcher to see.

The perceptions of each of the teachers was examined in relation to their perceptions of teaching, technology, using technology in the classroom and students. Each of these different perspectives gives a different view of how a teacher may identify with teaching and how their identity as a teacher may influence their teaching preferences.

All of the teachers had positive experiences in terms of using technology personally, though not all of that positivity transferred to using it in the classroom. Some of the differences in technology perceptions were based on how they felt it benefited their students and their goals for using technology and teaching in the classroom. This, in turn, seemed to guide their choices in their perceptions for using technology in the classroom, which ranged from tools for making grading and collecting work easier, to tools for producing more language products, to challenging their students to produce more language, to achieving some level of collaboration with the use of iPads in the classroom.

The teachers' perceptions of students were also examined, and this also showed some interesting insights in terms of the expectations of what students could do in the classroom. Many of the teachers felt challenged by working with students who could not use language as effectively as the kinds of students they were used to teaching. These limitations caused teachers to make adjustments to their teaching; in some instances they chose to change activities to less student-centered ones, in other instances teachers opted to allow for more productive activities, but with more limited goals. In either case, the

teachers' perceptions of the students seem to have been the driving impetus for their decisions.

In my discussion of supports, there were several aspects considered. These included the technological infrastructure and devices chosen for the classroom and the supports provided by the institution to develop the teachers' TPACK for using iPads in the classroom. I also looked at the teachers' backgrounds relevant to technology and using technology in the classroom before they became teachers.

In regards to the infrastructure and the iPads themselves, most of the support was sufficient for effective use of the technology in the classroom. Only three examples contradict this – one where Martina needed to charge an iPad during its use, because it had not been properly charged the night before. A second instance dealt with Maggie's continual need to find some place with a stronger WiFi signal, because she was in a temporary classroom outside of the building. Finally, all of the subjects found themselves without sufficient iPads by the end of the year because of increased enrollment and had to find ways to deal with that situation.

The teachers came from very different backgrounds, though three had experiences with technology which extended well into their childhood. The other teacher seemed to have some experiences with technology, which were similar to the others, he just was older when he started, and may use technology differently as a result. Also only two of the teachers had any teaching experience with using technology on a consistent basis prior to teaching at a school with iPads for all of the students.

I also examined each teacher's personal experiences relevant to appreciation for technology and iPads prior to becoming subjects in my study. This included an

examination of each teacher's personal training which included two from a 15-month master's certification program, one from a special dual certification program in special education and bilingual education and the fourth from alternative certification after starting to teach. None of the teachers shared any experiences regarding training for using technology in the classroom prior to their initial teaching experience. The teachers' philosophies were also examined, and each had their students' interests as a primary focus, although they expressed it differently. Their goals for integrating technology were usually related to their personal teaching philosophy, and they chose activities to support this in their classroom fairly consistently.

An interesting aspect was each teacher's perspective on TPACK and the use of iPads in the classroom. Martina took a perspective on TPACK which was focused on how to make her students independent learners, in line with her philosophy. This focus prompted highly structured lessons initially, but led her students to be more engaged in their learning later on. Maggie also aligned her perspective with her philosophy, and her activities focused considerably on engaging students in learning activities. Peter's philosophy and his perspective on TPACK were the least aligned, as his perspective of using technology in the classroom focused on developing activities which were more beneficial in terms of relieving his administrative duties. However, this did assist students by bringing in additional support materials from outside sources. Camilla was challenged during this year by having lower level language students than in previous years, although she still managed to find a way to develop projects for her learners to learn language as well as content in her classrooms.

School influences were limited to personnel issues, as the populations of each of the two schools was remarkably similar. In each situation, the schools allowed or provided technology training for each of the teachers in some way. Peter and Camilla had the benefit of being in the school at the beginning of the program and were able to receive training from the beginning. Maggie and Martina had less access to school-wide training and were mostly relegated (at least initially) to training sponsored by the district or Apple. Martina did start a professional learning community on iPad use which supported some of the members of her school.

Throughout my analysis, I commented on the number condition and availability of the iPads themselves, as well as the conditions of the infrastructure to support the technology. I noted that in most cases the numbers of iPads were sufficient, though later in the study this became a challenge. Also the condition of the iPads was generally sufficient for the students to use regularly. I will go further into detail about these analyses in the next chapter.

5. Chapter Five: Analysis

Case study research can use many different methods to analyze data. Among the more common is the constant comparison analysis. While this was developed by Glaser and Strauss (Glaser, 1993) for generating grounded theories, it can be used in other approaches to generate themes (Merriam, 1998a). My use of constant comparison analysis is to develop themes which relate to the theoretical framework created prior to the study, based on the research of Freeman and Johnson (1998) in combination with the work of Koehler and Mishra (2005) and around which the research questions were based.

After generating these themes, analysis of the data can explore the differences created by the sampling choices made at the beginning of the study. One sampling decision I made was to utilize critical case sampling (Patton, 1990a). Using this method enabled me to choose schools which had an intense situation of iPad use. Through this concentrated use of innovative technology which was provided to all of the students, I was able to study how teachers implemented technology in their teaching. The one-to-one implementation of iPads gives the study robust information regarding teachers' use and the training in the use of iPads in their classroom. With the selection of candidates I determined that the teachers could be categorized through the use of maximized variation and homogeneous subgrouping of teachers through their age and experience (Patton, 1990a). This has turned out to be a robust source of comparison.

Using my research questions as the underlying structure for my analysis I will start with a focus on the perceptions of teachers (their perceptions of teaching, technology, using technology and their students) (See question 1.a), and how they are affected by the two variables that I found to be important to the study. I will then discuss

the supports that facilitate the use of iPads for instructional purposes in second language classrooms and how they influence iPad use by the four teachers (see question 1.b).

Teacher perceptions

Teacher perceptions may be highly influenced by their prior experiences and experience. Freeman and Johnson (1998) discussed this in their seminal work, but more recent work on teacher identity also supports this notion (Hallman, 2015; Pennington, 2015). During this study I used two variables as a way of determining differences between teacher use of iPads. These factors were based on the age of the teacher (a strong indication of their comfort in and the ability to use technology), their experience with using technology, as well as their experience as teachers.

Prensky's (2001) use of age to determine digital nativism has been debunked in terms of generalizability (Hubbard, 2008, for example), because the age of a child has very little to do with their ability to use technology in its absence. Digital nativism is really more about exposure to technology rather than age, and how younger teachers are more likely to have been exposed to and have experience with technology at an earlier age. There is some evidence that the age of a student, and perhaps by extension a teacher, may have an effect on their use of technology (C. Jones et al., 2010). Because the age of the teachers and their exposure to technology at a younger age can be relevant to their use of technology, an examination of the teachers' age differences may provide some interesting insights. In this study, one of the teachers is clearly a digital immigrant, one is clearly a digital native and the other two are borderline digital natives, with considerable experience with technology from their family backgrounds and teaching experiences. The first two extremes in age may provide some insights in terms of

maximal variation; however, similarities between the two teachers of comparable age may provide insights into potential ideal cases: teachers with teaching experience who have sufficient technological capability to have considerable technological pedagogical and content knowledge. The other potential for analysis of differences, where teachers can be compared in terms of maximum variation or homogeneous subgrouping, is the experience of the teachers. Understanding the practices of the classroom was an important aspect of Shulman's (1986) pedagogical content knowledge: including the ability to adapt to not only new situations created by the classroom of students and their learning needs, but also to the availability of materials and technology. How a teacher adapts to these changes could well be considered a component of how experienced a teacher is. And while experience does not necessarily equate with expertise (Farrell, 2013; Richards, 2010), it does provide a level of comfort with teaching, teachers' practices, and hopefully, some amount of reflection (Farrell, 2013).

For the purposes of this study, I categorized the teachers into one of three different areas by both experience and age. The three categories I created for age I called older teachers, those who had very little opportunity to have experienced technology when they were young. (For this purpose, the teacher would have to be considerably older than someone born in 1980, perhaps by ten years, to ensure a difference.) I chose an age of at least 45, which would have been someone born in 1968. This age would be the "older" group. Then I chose a second age group which would be someone who would have had an opportunity to be a digital native, being born around 1980 – and at the time of the study would have been around 33 (C. Jones et al., 2010). This would be the group I called "fairly young". Finally, I choose an age group who would be just

beginning to teach, and would probably have the most potential exposure to technology. As ESOL teachers in my investigation's district need a Master's degree, a person in this category would need to be at least 24 years old, or someone born in 1989. This category would be the "young" group. Choosing these age groups also allows for the possibility of three distinct experience ranges, depending on when each teacher started teaching. The "older group" would potentially have up to 20 years of experience teaching; the "fairly young" group could have at least 10 years of teaching experience; and, finally, the "young" group would have limited experience teaching.

Teacher age and experience. This section sets up the rationale and organization for discussing the importance of age and teaching experience. In this study, both of these variables are important in that they lead to more dynamic teaching. Those teachers with the greatest combination of youthfulness (in this case a strong indicator of experience with technology) and teaching experience were more successful in creating interactive lessons and pushing their students to be more productive with technology while also managing their students more successfully.

The first group of teachers is composed of fairly young teachers who are old enough to have several years of experience teaching as well as being young enough to be considered marginal digital natives. As noted by C. Jones et al. (2010), a good age to choose is someone who was born in 1980, or a teacher who would have been about 33 years old at the time of my study. Both Camilla and Martina fall at or near this age range, and they have several years of teaching experience. Because of this combination, they are near a potential ideal of increasing experience and decreasing potential for digital nativism (see Chapter 3). Therefore, they may have more potential TPACK to use

than either an older teacher who might struggle with technology integration, or a younger teacher who would struggle with teaching expertise.

The second group consists of a young inexperienced teacher, in her second year of teaching, who is clearly a digital native. This teacher provides a maximum variation example for both the categories of age and teaching experience. Maggie is clearly the youngest teacher in the study, as well as the least experienced. On the other end of the spectrum (the third category) is Peter, who is both the oldest teacher in the study and the teacher with the most experience. While exploring each of these groupings, I will analyze how the teachers' similarities or differences impact five different aspects of the study: technological experience, the teachers' technology use in the classroom, the teachers' perceptions of teaching, technology, teaching with technology and the teachers' TPACK research.

Young experienced teachers – Camilla and Martina. My first subcategory of the combination of age and teaching experience coincides with the “ideal” cases that I described in Chapter Three. These teachers, Camilla and Martina, are fairly close to being digital natives, while also having several years of teaching experience. Their digital nativism is augmented by the fact that both teachers had experiences using technology when they were young (while more common, not necessarily really common). The examples below will help highlight their strengths.

Technological experience. This section highlights the experiences that Camilla and Martina have had with using technology in the classroom and before teaching or even learning to teach. This demonstrates that both teachers have a large amount of experience with technology, and it shows how they had already become comfortable with

technology well prior to becoming teachers. They both grew up with using technology, despite or as a result of being on the leading edge of digital nativism, and there may have been an expectation to use technology as a part their teaching, something which Camilla expresses.

In addition, they both used technology as students in their educational settings and as a part of learning how to teach – at least to some extent. And while neither one claimed to have had training with using technology with instruction, both were comfortable with using technology in their classrooms.

The differences between Martina and Camilla were not so much in their teaching activities, but in their ability to manage the hardware they used. For instance, Camilla was not only comfortable with teaching using iPads, but she could also understand the devices well enough to manipulate the devices to make them work better.

When I used to be on the iTeam, it was like, well ok, I could just fix that [technical difficulty] on your iPad, right now. I pulled myself off the iTeam last year, because I felt... the controlling of the technology, or the managing of the technology, overtook my teaching time.” (Initial interview, 01/30/14)

The iTeam was the all-teacher support team for iPads at Maverick Middle School, and Camilla spent the first two years of the iPad initiative on that team.

Martina was not as comfortable troubleshooting system settings and managing the hardware as it functioned within the district’s network – although she was very adept at managing software and anticipating issues students might have:

Now, when it comes to programming or stuff, like what we were just seeing [challenges with setting up the iPads on the wireless network] – I've not been exposed to that, or ever had to do it. I have no idea how to configure things, or how to set them up. (Initial interview, 10/17/13)

While she states that she was not comfortable with doing these things, Martina did spend considerable time fiddling with various aspects of programs. With these abilities in mind, her experience with setting up hardware, at least in terms of hardware on a school system network, may be limited more by her lack of access and experience than her lack of ability. In both situations, Martina and Camilla have considerable ability in terms of using technology.

One point of interest was a disagreement between the two teachers in terms of a particular piece of software. Camilla told me about how she found *Aurasma* troubling because of the way students were expected to use it in the classroom. She considered it a gimmick, because teachers at her school were using it only for its novelty, and only once or twice. They were introduced to it by the principal with an expectation of use; therefore, many of them were trying to get their students to create projects with the software, without worrying about the content of the application. Camilla felt that using the program became purposeless within her school, because the students focused more on the technology than the content:

One of them is called *Aurasma*.... I don't have it, but I've had somebody else [had it].... I went to look [at] this stuff. It's crap.... When you've got kids [using *Aurasma*], who are regular kids, who are writing two sentences to a picture, and that's supposed to be their analysis of the

picture. I've got questions. And then you're putting this all around the school for people to see.... And then, I should see more progression of projects, but then it [*Aurasma*] gets dropped [because], "Oh, I'm not using that anymore, because that's not the app we're supposed to be focusing on, we're supposed to be focusing on this app [the new app this week, whatever that might have been]". (Final interview, 6/12/13)

Camilla was troubled by applications which are not developed properly. She had not taken the time to explore *Aurasma* because she had seen how other teachers were using it, and did not feel it added anything to her classroom.

Martina, however, was excited about the possibilities of using of *Aurasma*, because she found purposeful uses of the software as a teaching tool. She shared her own account with her students where she could provide them with video support in their use of various activities – like reading or completing a worksheet:

I think *Aurasma* is the fullest potential. I think..., always... when you can come in the room and the whole room comes alive. Like where a kid can go up to the vocab wall, and find definitions, sentences, usage..., whether its teacher created or student created, or they can go to a work wall and scan their essay and see what the teacher has to say about it. (Final interview, 06/11/14)

Martina, thus, saw *Aurasma* as an interesting tool for classroom enhancement or for students' projects (creating videos about vocabulary words or books).

Each of these teachers formed their opinions because of their desire to have teaching situations which promote purposeful use. Through their discussions of the

classrooms they show the intentionality of using the technology purposefully, supporting their students' needs, which allows a closer view of their cognition. Camilla, on the one hand, saw bad examples of the software used through projects created by teachers who (according to her) were in a rush to impress their principal. Martina, on the other hand, had a good experience in her own introduction to the use of the software – because it came through the PLC on which she was trained; she later ended up training other faculty members at her school. Camilla and Martina had differences in the way the knowledge of *Aursama* as an educational tool was shared professionally (one learned about it as “school mandate” while the other got it through a training course she was teaching). This knowledge distinction made a difference in their uses of the technology in the classroom and the perceptions of each of these technologically savvy teachers as to the usefulness of a particular software package. These differences highlight a similarity in their purposeful use of technology.

Both Martina and Camilla had considerable experience using technology, both before they became classroom teachers and then as teachers in the classroom. While Martina was only in her first year in using iPads in the classroom, she quickly became something of an expert teaching others at her school new ways to use iPads in the classroom. Each teacher strived to use technology to support her purpose for supporting her language learners.

Technology use in classroom. This section considers how both Martina and Camilla use technology in their classroom, highlighting the similarities they share. Their experiences using iPads in the classroom demonstrate how their experiences with technology prior to teaching, and their experiences teaching have allowed them to have

greater expertise in using technology, and more specifically iPads; as a result, they have developed activities which are more student-centered.

As I analyzed the level of TPACK, I found it important to understand the level of TPACK integration according to Niess' (2011) growth scale (see Appendix B). In my evaluation of the research which uses this framework – especially Niess, van Zee, and Gillow-Wiles (2010) – I discovered differentiation of TPACK level based on a rich description of student-centered activities. From my review, their research indicated more teacher-centered activities at the exploring, adapting and accepting level of TPACK growth, and a focus on the more student-centered activities at the higher levels (Niess et al., 2010). While the purpose of this research was not to rate the level of Camilla's and Martina's TPACK growth, some discussion of it will help explain how successful they have been in implementing the iPads in their classrooms, and how their experiences and characteristics may have caused them to use particular activities.

Martina and Camilla developed very similar kinds of classroom activities. Their overall score for student-centered classroom instruction during the activities I viewed were both around 2.5 on a five point scale, with Martina's score being slightly higher (see Appendix K). They each had high numbers of activities in the 1-2 point range, with Camilla using a lot of presentation-type software to demonstrate things to her students, and Martina creating a lot of student activities which were either skills-based or were individual work requiring minimal thinking processes. While not exactly the kinds of activities you would expect to see in a highly student-centered classroom, or from a teacher with a high level of TPACK, the reasons for these activities may be more related to the language use level of the students, the content being taught (science and

mathematics), or the perceived need of the teachers to use teacher-centered activities to set up more student-centered ones. One of Martina's activities especially focused on a skills-based approach, where the students were finding parts of the body in *Build-a-Body* software, but she also used a skills approach during a demonstration of some vocabulary building software for the language class.

In general, however, both teachers had a fairly strong focus, an intentionality, to use project-based learning. I could see this in their discussions of the activities in the interviews and in their class activities; in several of their activities, the students worked on projects independently, and the teacher's role became more of a guide than a controller. In most of the instances, the students were not working in groups, but individually, so there is no real evidence of collaboration, especially in Camilla's case. Martina's class had the two instances of group work: one when students were performing a dialog reading for one of their partners who was recording it, and the other when students were performing an experiment in pairs and using their iPads to write down the activities and record the results. The fact that these students were doing project-based work at a newcomer level shows just how important that kind of work is to these two teachers. Each also had students use their iPads for research, with Camilla using specific web pages, while Martina was linking students to the information through the *InstaGrok* web page (a web page which serves as a resource for information on various domains and claims that you can "research any topic"). Both of the teachers worked toward project-based activities, though Camilla was probably more successful in this regard. And since they both afforded me several opportunities to observe, and Camilla's later lessons were less artificial, it seems likely that Camilla had a slightly higher level of cognition in terms

of how to create this atmosphere in her classroom – but of course she had more years of experience working with ELLs and iPads.

In his descriptions of activities for use by teachers at teacher perceived levels of student language use, Brown (2007) has suggested that lower use level second language learners will need more support for their language learning. For example “mechanical techniques are appropriate - choral repetition, and other drilling.... [A] good many teacher-initiated questions dominate at this level... [with] simple student-initiated questions [following at a later time]” (p. 119). He also suggests using activities in groups and pairs, and that it is important to use a “variety” of activities. Brown also goes on to indicate that teachers should not only consider the language use ability in the second language (L2), but also be aware of their students’ first language (L1) capabilities, especially in terms of reading and writing, as reading or writing beyond their ability in L1 may affect how students acquire reading in their L2. And while there may be limitations in terms of L2 grammar, the communicative function may be accomplished with a focus on using “uncomplicated language”.

Therefore, students with less language ability could very well be capable of using the language creatively, and teachers should work creatively to get as much functional activity out of their students as they are able. However, teachers working with lower level language use students will often need to provide other activities to support their language growth in other more teacher-centered ways. Since Camilla and Martina were working with students who were newcomer language students, it does not seem unreasonable that they would have a large amount of teacher-centered practices in their classrooms.

Camilla also suggested there may have been challenges using the iPads collaboratively. She had tried, when her school started running low on iPads for the newcomer students who were arriving at a rate of 1-2 a week, to get students to work together on the same iPad. She was not sure exactly why working together did not work, but she found that putting two students together did not encourage discussion; they still worked independently, just sequentially, not simultaneously. She suggested that the challenge may have been that they were discouraged from using another student's iPad from the beginning of the year (a school rule). Camilla also discussed many times her attempts to get her students to use more English in the classroom, which may have discouraged them from using Spanish to communicate academically (not that she discouraged this intentionally). There may have been other factors as well, which I have been unable to discern.

Camilla's challenge with using iPads for collaboration is an interesting example; discussing her challenges in using, and her attempts to explain why she was unable to empower her students to use iPads collaboratively, may show a lack of TPACK in terms of her ability to get her students to collaborate on the iPads. That she tried to do this shows it is something of interest to her, but she may not have tried extensively, as I saw few attempts during my observations, and she only spoke about it the one time. So, her intentionality of creating a collaborative classroom is clear, but her inability to get it to work successfully may show a lack of understanding of her students' needs or the needs of the situation.

Perceptions of teaching. Differences between how Martina and Camilla use technology in the classroom could be a result of their perceptions of teaching. This

section discusses their perceptions, highlights the similarities and differences, and explores how their perceptions influence their use of technology.

Martina and Camilla had similar perceptions of teaching, in that they were both interested in improving their students' skills through activities which promoted their learning. Martina wanted to develop independent learners, and she did this through lengthy modeled activities. She did not specify, but my assumption is that she was hoping that learners would be independent in terms of their language because of her instructional modeling. There were other factors that she discussed as well, including her students' independent use of iPads. This focus was evident in my first observation of her classes, with a long modeled lesson which lasted 55 minutes after which the students themselves finally performed the science activity and audio-recorded the lab report they had worked on throughout the modeled lesson.

Camilla's teaching style was to facilitate her students' learning. Because of her students' low level of language use, she struggled with projects. She wanted to create activities which were fun and would enable her students to produce language. Through these activities Camilla tried to facilitate her students' learning and language development. Like in Martina's classes, Camilla's students tended to work together on individual and group projects. In most cases, Camilla's projects seemed really to be individualized work.

Each of these teachers' ideas formed a part of their identity towards teaching. Their ideas about teaching, while similar, would contribute to their perceptions of students and how they would develop their ideas to support their students' work. The differences in their perceptions, and by extension their identity as language teachers,

would allow for differences in how they perceived technology use in their classrooms and implemented such activities. Their similarities may have nothing to do with their age so much as their experiences with teaching and learning, and how these influenced their practice.

Perceptions of technology and teaching with technology. The amount of experience teachers have with technology influences two factors: their perceptions of technology and its use in the classroom. Several researchers suggest that there is a link between experiences and practice in the classroom (Egbert et al., 2002; Freeman & Johnson, 1998; Hegelheimer & Fisher, 2006). So, an indication that perceptions of technology and its use in the classroom might relate to the variables of age (or experience using technology) and experience teaching would not be unexpected. This section explores the two most “ideal” cases based on their combination of teaching experience and level of digital nativism, and how Martina and Camilla compare in terms of their perceptions of technology and its use in the classroom to support the importance of its use. Any differences of opinion they had in my study only highlights how purposeful technology use is important to both of them.

Both Martina and Camilla had a positive impression of using technology in general. Martina chose Gran Torino specifically because of her desire to learn about using iPads in the classroom. Camilla was initially one of the teachers supporting and advocating for the use of iPads in the classrooms as an iTeam member, someone who supported the technology in the classroom. And while Camilla was not always happy about how other teachers and/or administrators perceived and/or used technology in the building, she still had a positive perception about using iPads with her students.

Both Martina and Camilla actively looked for ways to improve their own technology use in the classroom. Martina talked about working with her peers, pushing to run a workshop in their building and looking online and in the App Store for solutions to the perceived challenges with which she struggled. Camilla did not actively seek assistance from either her peers or through workshops in her building, although she had done so in the past. This may be because Camilla was an experienced teacher who had already taught with iPads, whereas Martina was in her first year using iPads in her classroom. However, in spite of her previous experience, Camilla continued to look for solutions to challenges either online or through the App Store. Sometimes she had consulted with peers in the past and had found some interesting ideas; generally, she did not report many new insights from peers during the study.

Each of these teachers identified with using technology in the classroom. Camilla was excited when her school converted to an iPad school and pushed the trainers to understand teaching ELLs to use iPads. Martina chose the school because of the one-to-one implementation of iPads. Each had worked extensively with technology for personal reasons and in institutional environments. Technology was a part of their teacher identity, and they used it often in their classroom. And, most especially Camilla, but Martina as well, understood that there were times when technology – and iPads – could be overused.

TPACK research. Another important factor to consider in terms of how teachers may be similar or different in terms of technology use and their comfort in using technology, is how they find new resources and activities to implement technology, or in this case, iPads in the classroom. One would expect that teachers with more experience

in instruction and in using technology would have similar methods for finding out about how to use the technology. Niess (2011) indicates that teachers who not only discover information regarding technology use on their own, but advance their knowledge by sharing it with peers (something that both Camilla and Martina have done with iPad use), reach the highest level in the framework evaluating TPACK (Advancing). Both Camilla and Martina advanced their knowledge within their first year of using iPads by teaching themselves. Again, it is a part of their teacher identity, and they are happy to share their experiences and knowledge with peers so that their peers can benefit from these same experiences.

Camilla and Martina shared several different ways to gather information regarding the use of their iPads in the classroom. (Peter and Maggie did the same, but the differences between all the teachers, as explained further on, were based more on their primary sources of information regarding technology than anything else.) Martina started out with professional development mostly offered by Apple in the beginning of the semester, before she even had iPads to use with her students. However, after she had gotten some of the basics under her belt, she used a lot more of her time doing her own research to discover applications either through searching or by asking peers what they used, and then experimenting with them in her classroom.

Initially, Camilla discussed all of the workshops and conferences she had attended to become more technologically savvy in the use of iPads or other related software applications. But during the school year, she spent much more of her time acquiring technology or finding out about applications from independent research which she did online. During my study, she did not talk much about finding out about applications

from peers (although she did learn about some). While both of these teachers attended workshops either over the summer, or at the beginning of their time in an iPad school, neither focused on that once they started teaching in earnest. Neither were they afraid to continue to modify their teaching, or look for materials independently to supplement their teaching during the school year. The similarity, then, between Camilla and Martina, in terms of how they acquired useful information to support their classroom activities, is that they spent most of their time searching for applications and/or modifying items which they found online. But there was one more similarity.

As noted, both Camilla and Martina became teacher trainers. Martina, in her first year of teaching at an iPad school, became trained in using iPads in the classroom so she could assist teachers at her school become more effective at using iPads in their classes. She collaborated with a peer to present to the Professional Learning Community which allowed teachers to become more proficient with their iPad use. Camilla, as has already been mentioned, was a member of the iTeam, which had mostly a technical support function, although there was also a pedagogical support role as well. (Peter mentioned this several times – that he learned about applications and iPad use from Camilla because of her expertise.)

Young inexperienced teachers – Maggie. Maggie was the youngest teacher, so she would be expected to be the most experienced in using technology, if she was exposed to it as a child – and this research holds this expectation to be true. She was the only teacher who would fall into all the age levels of a digital native as defined by C. Jones et al. (2010). But she was also the most inexperienced teacher, only in her second year of teaching, which would indicate some challenges with using technology to teach.

This section explores how her experiences with technology and her minimal experience with teaching affected her iPad use in the classroom. She made an effort to create project-based activities on iPads but her minimal experience, or lack of expertise limited her ability to create student-centered tasks on a regular basis.

Technological experience. Maggie's experiences with technology prior to teaching show how her age was, at least in her case, an indicator of how comfortable she was with using technology in general. The challenge that she faced was not so much how to use the technology, but how to integrate the technology into her classroom practice. Even though she was a digital native, she did not grow up with the practice of using technology in the classroom and had little exposure to these kinds of teaching activities in her practicum.

Maggie grew up with technology and using it (at least for personal experiences) was almost instinctual. She had lots of notions on how things worked, especially web-based software, which she could relate back to her experiences with Facebook and other similar kinds of applications. She had also grown up with a conception of using applications in a certain way: you log in, you have an interface to upload media (pictures, documents), you have a way of communicating with peers or others and you can make connections between peers or collaborate in groups. With this notion of how things worked, all Maggie had to do was figure out how a particular application did what she wanted it to do, and often that was very similar to what she had done with other applications.

Maggie's challenge was not so much about using technology, but using it to educate her students. During the study, she did not have much experience using

technology in the classroom herself, and it is quite possible that her minimal experiences as a student did not provide her with enough experience in how to use it. So, as she became more experienced, she had to figure out how to incorporate technology into her growing teaching skills. In some sense, her ability to teach and her ability to teach with technology were probably at around the same level: she knew about how to teach as well as she did how to teach with technology. She was not a particularly bad teacher, just not a very experienced one. And she had not developed enough of what Shulman (1986) would call case knowledge to help determine what different propositions to apply strategically to classroom situations. She did not have enough understanding of how her students would react, nor how best to manage the situation to use her technological and content knowledge in the classroom effectively in all situations.

However, Maggie did have the intentionality to use technology with her students, especially in project-based ways. During our first interview she told me about an activity she had used the previous year where she took her students on a virtual tour of the White House, through the use of *Google Maps*. The activities she showed me during the time I observed her class were all of a similar kind, where she had students working independently on project-based activities. She had some teacher cognition relating to the use of technology in the classroom, but had difficulty putting it into practice on a regular basis.

Technology use in the classroom. This section demonstrates how Maggie used technology in the classroom. It discusses the kinds of activities which she used, and how her lack of experience teaching combined with her considerable comfort with using

technology, produced bold but limited attempts to use technology in her classroom instruction.

Maggie was an outlier, in terms of my limited amount of time observing her teaching. She had the highest teacher-centeredness rating of any of the four teachers, with an average score of 3.38, which shot up to 4.25 when you only consider working with technology (see Appendix K). (For the other teachers, in their use of technology, there was only a minimal change between their regular activities and their activities with technology.) There were probably a lot of reasons for this difference with Maggie, one being that she was only observed three times. During those three observations there were only about seven activities (three in each of the first two classes and only one for the last class – a class long project). This low number of activities in three class periods is also an indication of her inexperience as a teacher – not spending the time to develop an activity through a series of steps, and allowing her students to get too involved in a singular activity, so that they do not finish (as in the last class). In each situation (except the last class) she had a warm-up (which consisted of two activities – independent student work and full class discussion/review) and a “project”.

Also, of all the teachers, Maggie was the one who successfully used iPads in a collaborative way. And she did this twice! The first collaboration was happenstance, or so it seemed. I am not sure exactly what she was expecting me to observe that day, as she had only planned a video-recording activity. Based on later discussions, the iPads were not set up to use the camera to record video, as, according to her, the cameras were locked. Also, she was not expecting the students to get to the point of recording (and they did not). However, one of the students suggested writing their scripts (for their

video) on the iPads. After thinking about this, she agreed, and they were supposed to each write the whole script on their own iPad (i.e., all students have an exact copy of the same document, which they had individually typed). This was not the most innovative use of technology for writing (a prime possibility for online collaboration), but with her challenges with the Internet, she may have felt it necessary. Still, whether one person was typing, or multiple persons, they were working collaboratively to create a script. In the second activity, the student groups were in the process of recording their video, and at least one group found a way for each person to use an iPad while they were recording the activity (script, timer and camera). This event is interesting because it highlights a secondary element of intentionality – understanding the impact of students’ suggestions on the classroom. It shows that the students have a desire to use the iPads for learning as well as the teacher does; in Maggie’s case she seems to always try to give her students the opportunity to use technology whenever it is appropriate, even if it was not initially her idea.

Another likely reason that she was more successful in working with her students to create collaborative activities, at least in the two activities mentioned above, was that she was working with higher-level language use students. These students were not newcomers, but “beginners”, which was one level above “newcomers”. With these higher-level students, she would be able to work with more of their language, getting students to develop beyond an individual skills-based activity level.

Two reasons occur to me as to why I did not see any more of Maggie’s classes than I did, and this would have some bearing on the activities I saw. I did not just show up in each teacher’s classroom: I made agreements to meet them when they thought I

would have something to see. I did not want to walk in on a day when the teacher was testing and/or not planning to use the iPads. (Again, the challenges associated with this were realized on the day I came to see Martina's class, and she ended up changing her whole schedule because I was not expected, and she *had* planned a test). Part of the reason I think that Maggie did not encourage me to visit more was that she would have had challenges getting the iPads for her classroom when she was sharing them with Martina. She also had issues using iPads when there were too many students because her Internet access was poor. Even then, two of the three classes that she invited me to observe, for various reasons, were limited in terms of the technology/iPad use planned. And, perhaps because the first of these was so disorganized (it was the same day her class size doubled because several of her students moved from one section to another), she may have been discouraged from inviting me unless she had a solid plan, with great productive activities.

However, the lack of invitation also could have been because Maggie was an inexperienced teacher and the time required plan a visit could have resulted in too much of a burden. Looking over emails exchanged, it took nineteen emails over a seven day period just to schedule a visit to hand out consent forms for students. Another ten emails over a month were needed to schedule my first visit. In each situation, I sent a second email after a period of time, after she had not responded to the first one.

Regardless of which of these (or other possible) challenges limited my access, when I got to see her, Maggie certainly talked about using activities which were productive or product-based. She told me about an activity she had done the previous year, when she was able to get in another teacher's classroom. She had an intentionality

to use the iPads in a project-based way with her students, and this may have taken significant portions of her cognition, or her planning resources, simply to schedule an activity of this type. Because of the way she felt challenged by using technology, and the effort it took to find other rooms in which to hold her classes, she did not search for alternate rooms every day, or even often, since it took too much of her time. With all these obstacles, I would have been surprised if she had used technology in her classroom for significant periods of time during any class, which may be another reason I did not observe her as much as I wanted to.

Perceptions of teaching. Maggie, as the youngest of the four teachers, may have perceptions which are different because of her age, as perceptions of teaching may be influenced by the age of the teacher. Therefore, an examination of her teaching perceptions may be an indicator of the kinds of activities she may attempt. Perceptions, while an indication of her identity, may not be a true indicator of what she is willing to do in the classroom. There may be other factors which limit what a teacher is able to do, and in this case experience may play a strong role in how Maggie's perceptions and identity are constrained.

Maggie was interested in assisting her students develop learning skills, though she was more focused on developing academic skills. The idea behind developing these skills may have been more appropriate for her situation, because she was working with some students at a higher language use level than the other teachers, even if marginally. Maggie, however, wanted to get her students more involved in their learning – to become active participants. Her goal might have been a strong reason why she had several project-based activities in her classes. Her intentionality of creating project-based

language activities, especially on the iPads, was expressed in the few lessons which I was able to observe.

Maggie's perceptions allowed her to try to create activities to allow her students to learn through experiencing language processes. However, it is possible that one of the reasons I did not get to see her often is because the numbers of these activities were limited through her inexperience with planning, creating these activities and coordinating with an outside observer.

Perceptions of technology and teaching with technology. In this section I explore Maggie's experiences with using technology, her lack of experience using or seeing technology use in the classroom, and her limited experience teaching with or without technology, which all have an influence on her perceptions of technology and its use in teaching. I can also evaluate a change in her perceptions from the beginning of the study to the end based on the Personal Learning Community which was co-taught by Martina.

Maggie generally had a positive perception of using technology in the classroom, and she always had a lot of new ideas for how to use technology in the future. She wanted to "flip" her classroom (create teaching modules so that students can learn new information at home, and then come to school with that additional knowledge so that they would be able to actively pursue engaging activities in the classroom). She was also excited about the possibility of students using technology either for research or writing projects. This excitement is one reason she was very interested in the idea of *Chromebooks* (small laptops which run using *Google Chrome* operating system – another cheap solution for classrooms).

Maggie was excited about these ideas, and many others that came her way, but was challenged in changing her classroom in many ways. As an inexperienced teacher, she still found it challenging to control her classroom at times. When we discussed visiting classes in October, she said that I could visit either of her newcomer social studies classes. However, she was only willing to let me visit one of her beginning language use classes, because the other was more challenging to control and she did not feel comfortable with me observing it. (This might have been either because of my possible effect on the class or because she did not want me to see such a challenging class). By the end of the year she was willing to lift that restriction. She also was challenged by her classroom situation: while only in her second year of teaching she remained assigned to the temporary classroom. This second challenge made it difficult for her to use technology consistently.

A third challenge for Maggie might have been that she had not taught as much as the other three teachers, so she was limited in how to implement some of her ideas into an iPad (or other) classroom. Having taught a class without technology can be either a bane or a boon. As Zhao (2003) has indicated, the use of technology in a classroom is not so much a methodological change, but a change in tools. So, by extension, familiarity with teaching is simply applying the method you are most comfortable with to a new tool set. Prior experience gives familiarity to methods which have been successful and which may make it more difficult to embrace innovation. However, it may also provide a framework for teaching which can be transferred to another tool, whereas a younger teacher with little teaching experience may lack this ability. Because all of the teachers in this study came with their teaching and learning experiences [Freeman and Johnson's teacher as

learner (1998)] based primarily in non-technological situations, they had very little experience to draw upon to create innovative technological practices. Having experience teaching may be a great advantage in this area. With more experience, it becomes more likely to be embedded in a teacher's identity. Maggie was obviously interested in using technology, but since her teaching experience with technology was limited, she probably spent more of her personal resources planning activities which would use the technology productively.

TPACK research. In this section I examine how Maggie's comfort in researching how to use technology on the Internet, contrasts with her lack of comfort in looking on the Internet for activities to use in her classroom. It seems, through her use of the personal learning community (PLC), and her experiences with the training prior to her first year teaching, she demonstrated she was most comfortable learning in an environment with more experienced teachers, than searching for these activities on her own. Her experiences in the PLC assisted her in creating more kinds of activities for her classroom iPad use.

Maggie did a lot of her own research, and she used peer support and training courses; however, she seemed more dependent on training courses. And she did not really discuss her information with other teachers. This was highlighted by the fact that at the end of the year, after she had attended Martina's PLC, she started to realize that after two years of working in a low bandwidth Internet environment, she could do activities on the iPads which were not so dependent on the Internet. This event gives us an insight into the development of her teacher cognition regarding iPad use. She had a

computer/*Chromebook*-based notion of how to use iPads in the classroom, but had not considered some inherent differences that iPads use, like non-Internet based applications.

Another point of interest was that while she did look for materials online to supplement her teaching, she was not as willing to change her teaching. She discussed at the end of the year how she would make changes the following year based on ideas she had picked up in the PLC (which admittedly ended not long before the iPads were removed from the classrooms). She may have been more comfortable with change if the PLC had ended in the middle of the year, but she seemed more likely to make slower changes rather than rapid ones, based on newly acquired knowledge.

Older experienced teachers – Peter. Peter is a separate case from the other three teachers. He was the most experienced teacher by several years, which meant he had the potential ability to be more adaptive in his teaching to the needs of his current group of students. However, because he was older, he did not have the experiences using technology until more recently. Because he did not grow up using technology, it is probable that his comfort with using technology was limited to the activities which he had created for himself. In addition, these activities seemed to be more limited to management tasks than actual teaching practices with using iPads in the classroom.

Peter had taught for ten to fifteen years at Maverick Middle School, and for all of that time he had taught ESOL. He was in his third year of using iPads in the classroom, and in terms of previous technology use, he spoke about how he had used it for personal use, but not so much about how he had used technology with students. It is very possible that prior to the iPad implementation initiative, he used technology in only a few different ways.

Technological experience. This section highlights what kinds of technology experiences Peter had had prior to his teaching experiences to demonstrate that since he is older, his experiences with technology (while in some ways similar to the other teachers) did not start until much later in his life. Because he started using technology later, his comfort level was lower especially in novel situations like teaching. This lack of comfort is demonstrated through his limitations in his ability to quickly acquire new skills in using technology, especially in the classroom, quickly.

Peter was different from the other three teachers among the four subjects in this study in terms of his age and prior experience with technology. He grew up without comparable technology experiences, and had taught for many years in the classroom without technology. Yet he had developed some level of comfort and acceptance with using technology. Peter seemed to be more comfortable using technology for himself than with his students. He talked extensively about how he used technology to communicate with his peers around the world, but talked very little about how he used technology in the classroom. There seemed to be something of a disconnect here. Even when he did talk about classroom use, he spoke more about how he used technology to manage grading or provide materials for students than to help them learn. His thoughts here are interesting because they express the intentionality that he had improved his teaching through the use of iPads, but the way he uses it is not an improvement that would most benefit his students learning: he used it to benefit his management of students and resources.

As Kern (2006) has suggested, technology can be used as a tool as a part of language learning – like pens and chalk – but others working in the field of TPACK

(Niess, 2011; Niess & Gillow-Wiles, 2013) have suggested that those teachers who have experienced further growth in TPACK would have more student-centered activities.

Peter's classroom did not seem to have experienced this growth, despite his acknowledgement that there had been some change in his teaching. This is aligned with Zhao's (2003) conclusions that technology does not change teaching.

Technology use in the classroom. This section discusses the ways Peter used technology in the classroom, and especially highlights how he focused on using technology for more administrative tasks, like grading and collecting work. His tasks are more teacher-centered than those of the other teachers because they focus on activities which do not help the students learn, but help Peter organize his ideas and collect and grade materials.

Peter's classroom activities were the least student-centered of the four teachers in the study. He had an average rating of 2.27 on the student-centered classroom activities scale (see Appendix K). It was not surprising that he had the lowest average, since he was also the only teacher who had nothing in the five range on that scale. His experience in teaching and using technology made it much more challenging for him to engage in student-centered activities and innovative uses of technology in his classroom. The ratings of his activities also agree with what he said were the changes he had made in his teaching: speeding up grading, collecting homework, providing online worksheets for students and using online skill activities. His use of technology, which had transformed his teaching, in general, seems mostly to support his teaching purposes (grading, distributing worksheets, etc.). Here his intentionality to improve the management of

students and resources seems to have been realized, but any intent he had of improving students' activities was lost in this process, at least during the classes I observed.

Still, it should be noted that (although I did not see it) Peter was not without some project-based activities – he told me about them when he was discussing how one of his students taught his class how to use iMovie. It was also important to note that despite his experience with using technology prior to the iPad project at his school, he was successful at integrating technology into much of his classroom activities. Of the activities I observed (about 34) almost all of them had some technology use, and most of them had some iPad use as well. It was the rare activity (when students were reading from the textbook) where they did not use their iPads. This integration shows that while his level of TPACK integration may not have been as high as the others (in terms of transforming his classroom to a student-centered classroom), he was at least able to integrate the use of iPads into activities which likely have been part of his teaching repertoire for many years, and with which he is comfortable. In this sense he seemed to be on the cusp of ‘adapting’ (see Appendix B) his previous teacher-centered activities from the non-technology classroom to the iPad-centered classroom (Niess, 2011).

Perceptions of teaching. Peter's perception of teaching is indicative of his more lengthy experience. Either because of his age, or the fact that he has taught for longer, his perceptions of teaching reflect teaching styles that have been challenged with the sociocultural turn. So, this perception brings a difference, at least in the way he predominately works with the students in his class, and is indicative of a focus on skills-based instruction with more teacher-centered activities.

Peter was interested in developing his students' learning skills, because he wanted them to become successful. However, this "development of learning skills" was less clearly defined, as he did not discuss what he meant by success. To compound this lack of clarity, he also said that he wanted to "reach his students", which was also somewhat nebulous. Since he had a very structured and predictable class, his students seemed to develop habits of mind, which allowed them to understand the kinds of activities they might need to be successful. It may also have given his students comfort as to what was expected of them in most situations, where a less structured class would have provided more uncertainty.

The development of his teacher identity from which his perceptions of teaching and other aspects of his class might be derived, might have less to do with his age than his experiences as a teacher and learner. Learning how to teach in this country would have provided some similarity with the other subjects in this study, but the development of his identity from prior learning in his practicum might have been colored through the lens of an outsider whose formative experiences with education might have been vastly different. Yet, his experiences might have been more representative of what immigrants need to be accepted in this country.

Perceptions of technology and teaching with technology. Peter's perceptions of technology and using technology to teach are indicative of how much time he has spent using technology. Again, there is a focus on how technology helps him teach and improve his teaching by, for example, creating lessons which are more visual through the use of images found on the web. He appeared to focus less on actual creation of student-based activities, which seem very limited in the classes he teaches.

Peter seemed to have a very positive perception about using technology in his classroom. He used technology regularly in the classroom and always discussed its benefits. His perceptions, however, may have been more colored by the teacher-centered benefits he focused on. Martina, Maggie and Camilla all discussed how they could use technology to advance student learning, especially through the use of project-based activities. Peter focused more on the advantages of skills-based assessments – how using technology made grading discrete point activities quicker. So while having a positive perception of technology use, it seemed more teacher-centered than the other three. His intentionality to implement activities which were more skills-based demonstrated his lack of cognition regarding some of the real benefits which technology can deliver – project-based learning, and 20th century skills (collaboration, etc.).

While Peter seemed to be content with the state of his technology use in his classroom during the school year, he took this further by not pursuing any technology training. Peter gave the impression of being the kind of teacher who liked to add one or two ‘innovations’ to his classroom practices during the course of the year. Since the arrival of the iPads, he had found a way to implement them in his class making considerable use of them (perhaps more than his peers) – but his use of iPads did not mean that he was making rapid changes to his classes. From watching his classes, I had the impression that Peter was very comfortable with what he did, and that he had used most of the activities for a long time. His level of comfort did not mean that he is a poor or bad teacher – most experienced teachers will become comfortable in a certain style of teaching and be reluctant to change. Change in teaching has challenges at every stage, but perhaps the desire not to do something new becomes most ingrained as teachers near

the end of their careers. As Hubbard (2008) and others (c.f. Robb, 2006) relate, it is a challenge to keep up with the constant change of technology as your career continues. However, this means that if the administration desires to implement change, it will need to consider how to convince the most traditional teachers to adapt in order to be successful. And while Peter had added iPads to his classroom repertoire, he did not seem to have affected a change in his teaching methodology.

TPACK research. Looking at how Peter acquired knowledge of iPad use is another indication of how teachers' perceptions affect their use of technology and how they learn about using technology in the classroom. Peter learned very little through the school year, or by his own initiative. He acquired one or two applications a year, and then stayed with them throughout the whole year. He seemed to benefit mostly from exposure through practice with other professionals, rather than looking online for new ideas, or trying out new things. Peter was very comfortable with what he did, and seemed to like that.

Peter was like all the other teachers in this study in that he claimed to use peer support and personal research, and engaged in professional development to augment his TPACK and the use of technology in the classroom. It seems clear, however, that in order for him to change, he had to have some significant professional development – and that he would not change his own technology use on his own during the school year. The one activity he changed was because one of his students convinced Peter to let him try out using iMovie as a project creation activity. This was something that did not challenge Peter significantly, in that he did not have to teach his students to use iMovie, change the particular activity, or provide any other kind of support. He just needed to be able to

view the presentation to grade it. Allowing other students to learn how to use iMovie was just a matter of giving one student some class time to teach them.

Teachers' perspectives on technology

Having explored their perspectives, it is important to compare and contrast the different teacher perspectives and how they may influence instructors in their use of iPads. In this section I will discuss several aspects: the similar perspectives of Camilla and Martina, the differences between them and Peter and Maggie, and the differences and similarities among all the teachers. The similarities and differences show patterns of behavior which are consistent with the expectations of their perceptions, as expressed above.

Teachers' perceptions are embedded in their identity and the agency they are able to employ in the school context (Hallman, 2015; Pennington, 2015). The context exhibits norms for how technology should be used, as it also affects other aspects of teachers' educational practices. How teachers are able to identify themselves in this context will influence how they see themselves using technology in the classroom. Also, the amount of agency they have in this context influences their actual technology use. If educators perceive technology as useful, then they will make more of an effort to make use of it; without this perception, they may decide to minimize its use (Ertmer, 1999).

Ertmer (Ertmer & Hruskocy, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Ertmer, 1999, 2005) has written extensively about how teachers' perceptions of technology can influence how they use it. When a teacher's perception of how to use technology in the classroom interferes with the ability to use technology, Ertmer calls this a second order, or intrinsic barrier to its use. She considers this the most

significant barrier to effective use of technology in the classroom. And while there were significant barriers of what Ertmer would call first order, or extrinsic (like Maggie's bandwidth challenge), much of how the technology used in these classrooms (when it was) was based primarily on these second-order barriers.

Young experienced teachers – Martina and Camilla. Martina and Camilla have very similar perspectives on teaching, using technology and teaching with technology. It is also true that they have had very similar experiences in terms of their years teaching and their use of technology prior to teaching. There are differences in the ways that they came to teach language learners, and this may have influenced how they perceive students (see below), but in many ways they were interested in developing activities which are purposeful and help the students develop language products or language use activities.

Camilla and Martina came to the classroom with similar experiences and similar technological knowledge. Their differences were more in the form of kinds of experiences: Martina had more experience in working in the classroom, especially the ESL classroom, while Camilla was more experienced in terms of her knowledge and ability to work with hardware. Another difference between these two teachers, at least in terms of iPads, was that this was Martina's first year using the iPads with students, whereas Camilla was in her third year.

Each of these teachers had a positive impression of technology use in the classroom in general and wanted to encourage purposeful technology use. Camilla's perspective was more colored by three years of working through the bureaucratic hurdles which were hindering her ability to do everything that she wanted. Both teachers were,

however, struggling with a new situation – both were teaching science to newcomer students. Their other classes were two levels/ages of ESOL mathematics or language arts.

Similar activities. The activities in this section are discussed because they are similar in that both Martina and Camilla use them. These activities may be an indication of how teachers use activities when they have experience both in using technology and using technology in teaching, and perceptions with the use of technology and teaching which corresponds with that experience.

Based on a tabulation of the kinds of activities the students participated in, three of the teachers had a significant number of student tasks which fell in the 1-2 range of student-centered activities (see Appendix K). This means that these teachers used a lot of activities which were drills and skill work (level 2) or memorization (level 1). Camilla had 20 out of 31 (64.5%) activities which were in this range, while Martina had 31 out of 38 (81.6%) of her activities in this range. Each of the teachers also had larger portions of the goals (discrete facts and comprehension) of the class (53.3% for Camilla and 70.6% for Martina), poses (presentation/dictation and presentation with yes/no questions) (60% for Camilla and 68.4% for Martina) and technology use (presentation and skills-based use) (Camilla 86.1% and Martina 59.3%). In each situation these two teachers had the largest portion of their activities in the teacher-centered area for these activities. And it makes sense that activity goals, student tasks and teacher poses (see Chapter Three) would be similar. The goals of the assignments dictate to some extent the kinds of activities students would engage in as well as the teacher's poses (questions, comments,

etc.). Also it is logical that the goals and activities of class would drive the kinds of technological activities the teachers employed.

I have already mentioned that there is a compelling reason why these teachers might not have scored higher in terms of student-centered activities – they were working with the lowest level language use students. Since all the teachers were working with the lowest level students, and three out of the four were working only with these lowest level students, the language level of the students is less of a confounding issue in terms of why teachers are using student-centered activities. As Brown (2000) has suggested, lower language level use students should be given more supporting activities for their language learning, which often leads to more teacher-centered activities at this level. Because of the use of more teacher-centered activities with lower level language students, and to see if there was a difference between the teachers in their kinds of activities, it was important to look for subtle differences in how they teach. In the following example that means subtle differences in the level of teacher-centered activities. The main differences here were how Camilla and Martina focused more on project-based activities, although all four teachers talked about it. I saw it in Camilla's, Martina's and Maggie's classes, but in Peter's class and in his discussion of technology use, I saw more of a focus on the teacher: teacher-centered activities like skill and drill activities and teacher support through administrative duties.

In terms of Camilla's use of project-based activities, I was able to observe students working independently on projects multiple times. In her mathematics class, she had students use manipulatives to create a physical representation of several different kinds of fractions (e.g., four blocks of the same size put together could represent $\frac{4}{4}$ –

pull one off, and lay it to the side, now you have 3/4). The students were supposed to take pictures of this so that they would be able to describe their fractions. In science class, she had the students investigate different kinds of animals (habitat, eating habits, vertebrate/invertebrate, etc.) to make a research-based report for the class to see.

For Martina, I only observed one project-based activity which was a full class lab. This activity consisted of many different activities as a part of the whole, much of which was fairly teacher-centered. In order to teach the students how to use the application that they were going to use to record the lab results, Martina had to direct them through the lesson step by step. Still, there were points during the lesson where she stepped back and let the students think for themselves (when they made their own hypothesis of what would happen with baking soda and vinegar) – and there were several opportunities for student modification (one student suggested putting all the procedures on one slide). In the end, the students had to record their own results orally by going through the slides they had just created as a class and recording their explanation along with each slide. This certainly made the activity more of an individual project. Also (although I did not ever see it) Martina suggested that after this first lab using the software *EduCreations Interactive*, students could record their lab experiences. The students would then become more responsible for their own lab work as the school year went on. In this instance Martina used *EduCreations* as a ‘tool’ and to ‘communicate’ in terms of Means' (1994) categories.

Different activities. Just because two teachers have similar experiences and perspectives does not mean that all of their activities will be the same. Differences may be indicative of personal teaching styles, the subjects they are teaching, or other factors –

like student perceptions (see below). One difference between Martina and Camilla was their focus on the use of technology in the classroom when observers were present. Camilla had no qualms about others observing her use of technology (whether I was there or if other official visitors came to see examples of good technology integration); she allowed her class to proceed as if no one else were present. She had no desire to force her students into a situation where they were using technology just because there were visitors present. She did not want to have a “dog and pony show” for her observers just because they were there to observe her technology use. However, every time that I was in her classroom, there was at least some use of technology. I am not sure why there was always technology in use, as she mentioned that observers had come on a day when she had not used the iPads. It is possible, perhaps most likely, that this comment was an indication of the regularity with which she used technology and the iPads in the class. It is somewhat less likely that this had to do with her thoughts about what I might see when we scheduled the observations. In our discussions about visits, she seemed more concerned with her presence in the class, or the presence of others, than her choice of activities. She would have said something like, “Come in that day, I’ll be in, and there won’t be any other observers in the building”. It is also possible that she changed her lesson, despite the rhetoric. I find this last option the least likely.

Martina, on the other hand, seemed to want to make sure that I was given a “show” whenever I came. The first lesson was a long drawn out demonstration of using a software package at the same time that the students were working on a science experiment. I believe that she wanted to show how she demonstrated the use of the application at the same time as teaching the students science (and language). She

probably chose a class and day to show off this lesson – and again my presence was negotiated. I also believe that there were several times that I came into her class and saw “normal” activities. However, she had her students change from taking a test to working on activities that would be more appropriate for me to observe on another occasion. Again there was a negotiation, as she wanted to show me her science class so the students could take the test she had planned. I was adamant that she should not change her schedule because of me (she could teach the language class later in the day when the same students had her for science). However, she changed her class and postponed the test. And while I told her I could come back another day, she insisted because of the time of the school year and her desire not to inconvenience me.

Teachers with contrasting perspectives. Since Martina and Camilla fall into a more “ideal case” of teachers currently using technology, a comparison of the kinds of activities that were similar or different with Maggie and Peter indicates differences in their strengths in teaching with iPads. Strikingly both Maggie and Peter were challenged in their ability to acquire experience in teaching with technology. However, they were also different in their focus in how they wanted to use technology when they made the attempt.

Martina and Camilla had similar perspectives regarding use of technology in the classroom. Camilla may have been more successful in terms of how to create and demonstrate student-centered activities and project-based learning than Martina, but both had student independence as a goal. Maggie also seemed to have a similar perspective, at least in terms of her goals. Through my limited observations, I was unable to determine how successful she was; still it was her goal, and the majority of the activities I saw her

use were student-centered, and she had even greater success than Martina and Camilla. Perhaps, as I have previously discussed, her success might have been caused simply because she was working with higher level language use students.

Peter's case was completely different. While my conversations with Peter provided tantalizing hints as to project-based and/or student-centered activities, I did not observe any of these kinds of activities during my seven observations of his four different classes. What I did observe were very structured activities where the teacher was controlling how he set up the activities and how he guided the students through them. His most student-centered activities had to do with summaries that students wrote independently about classroom readings. Summaries were just one of many activities which the students had to complete with the reading of each chapter – regardless of the class they were in (social studies or language arts). Most of the other activities the students participated in were using *The Rosetta Stone* (a skills-based software package which uses multiple-choice questions to allow students to learn vocabulary and basic grammatical structures) and *Achieve3000* (a comprehension focused lexile leveled reading application with multiple-choice comprehension questions afterwards.) Most of *Achieve3000's* questions probe the students' understanding at a lower level, although some may be higher order questions, which emphasized skills (vocabulary and comprehension) rather than products, and in the 'tutor' category (Means, 1994). Other activities included defining key vocabulary, searching through reading passages for main ideas and focusing on the meaning of text features and other elements of reading. In fact, much of what Peter worked on was either focused on reading skills, or writing (with a little production, but nothing obviously creative).

While the scores for the level of student-centered activities (see Appendix K) were not very different between Peter (2.27) and either Martina (2.59) or Camilla (2.63) (with Maggie's 3.38 being considerably different, for previously discussed reasons), there was a significant difference in one area, and that was in terms of the number of 5's that Peter had in comparison with the other two teachers. Peter had nothing which was rated a 5 on the student-centered activity scale, whereas Camilla had 18 ratings of 5 and Martina had 12. Peter also only had 27 ratings of 4, as compared to 37 for both Martina and Camilla.

Comparison of the numbers of activities in each category is challenging for many reasons. All three teachers had different numbers of observations (seven each for Martina and Peter, and eight for Camilla); they also had different number of activities observed in their classes (about 34 for Camilla and Peter, and around 38 for Martina); it is also difficult to determine the number of activities, because not all activities were rated for every category of student-centeredness (because the ratings were based on observation notes, there was not always a clear idea of poses given, for example). Still the differences are large, and Peter's lack of level 5 in any category of student-centered activities seems to support the notion that he was not as open to giving students as much of a chance for autonomy.

Similar activities. In general, there are many activities that all the teachers use, or want to use. Factors that indicate which activities teachers will use may be related to their goals of teaching language to students who need linguistic assistance. But there may be other factors as well. Also, even if teachers use the same activities, there may be differences in foci, which may be due to their perceptions and experiences. The

similarities of the activities which all teachers used will be differentiated through their particular focus, and how often they use them in their classrooms.

Like Martina and Camilla, a lot of the activities Peter used were drills and skill work (level 2) or memorization (level 1). Peter had 18 out of 27 (86.7%) of his activities in this range. Peter also had a larger portion of the goals of the class that focused on discrete facts and comprehension (79.4%), poses (presentation/dictation and presentation with yes/no questions) (73.1%) and technology use (presentation and skills-based use) (74.2%).

Many of the activities that all four teachers had in common included teacher-centered activities: projection of classwork or homework for students to compare answers with the teacher and/or other students; presentation of new material using the projector; and using The Rosetta Stone by at least two of the teachers (Martina and Peter). Most of these activities did not really involve iPads, as they are projections of materials (either through a document camera or occasionally the iPad). Such activities were commonly used by all the teachers, but most often used by Peter.

While many of these activities were teacher-centered in nature, there are always going to be teacher-centered activities in any classroom – these include giving directions and presenting new material. However, as I have already mentioned, Brown (2000) has suggested that lower level language use classes will have more teacher-centered activities than higher level language classes, merely because of the difficulty for students to perform in a language when they only have limited language abilities. All of the classes (except for two of Maggie's) were of the lowest level language use students, with a “newcomer” status. Also, all teachers used these teacher-centered activities; only Peter

did not move beyond them to more student-centered project-based activities during observation.

Different activities. There are several activities which only one or a couple of teachers used. This may be an indication of how different experiences lead to different perspectives and perceptions of what kinds of activities are most useful for the teaching of language. In some cases, though, teachers did not use a particular application because of technical challenges. These challenges may have made the application unusable for all or most of the year I observed. Also, the effort required by the teacher to get support for the application may have been an indication of their importance, or it may have been beyond their control. Time to acquire an application is not always due to the support received, but is also dependent on the effort teachers are willing to put in to acquire the training and/or tools they need to use said application, which again would be an indication of importance.

Peter used some teacher-centered activities that other teachers did not use. These included (in terms of Means' (1994) categories): collecting work through *Edmodo* (a tool for teacher created activities which can be either teacher or more student-centered/product based is classroom management software which teachers have to provide content for, but allows for activity creation of different kinds); providing students with multiple choice assessments (tutor) on *Edmodo* (although Maggie talked about doing this in the past); and practicing reading (tutor) on *Achieve3000*, which Peter used regularly and Maggie talked about doing in previous years, but I never observed. And finally, Peter used *The Rosetta Stone* (tutor) regularly, while Martina used it once (although she suggested she would use it more once she got it working). These activities

provide a bit more student autonomy, in that students are working independently, even though they are not typically higher-order thinking activities and are in the lower half of Murray and Olcese's (2011) categories.

Maggie was somewhat of an outlier in terms of both the number of observations, and the level of student-centered activities. I have already mentioned in the sections above about Camilla, Martina and Peter having a large number level 1 and 2 poses and technology use; Maggie's numbers were similar, with 50% of her poses as well as 66.7% of her technology use being in this range. But Maggie's percentage of level 1 and 2 goals (28.6%) and activities (33.3%) were much lower than the other teachers. There are at least two possible reasons for this: 1) she had a higher level class and 2) I was not able to observe her class more than three times, leaving what the observations measured somewhat suspect in terms of what she would do on a daily basis. There is a possibility that the classes may have either been chosen specifically, or she may have altered her teaching style for these three classes.

While Peter mostly did more teacher-centered activities, many of these activities were done in some way by most or all of the other teachers. The primary type of activity which the other three teachers used, but Peter did not, was project-based. Each project was different. In Martina's class, I observed a science experiment which was well controlled, but set up the possibility for more independent activities later. Maggie and Camilla both had students do research on the iPads – in Camilla's situation, sometimes the iPad research augmented what students did in books, whereas Maggie's seemed to be mostly online research. But in both instances the materials were used for projects which

were created on the iPads. Maggie also did a project where students collected photos, wrote scripts to create videos, and performed what they wrote themselves.

Camilla also used *BrainPop* videos to introduce various topics – something which none of the other teachers used when I was observing – although Martina tried to use it once and it did not work, and Peter talked about using it “a lot”. *BrainPop* is a tutor website (Means, 1994) with a lot of educational videos with a small number of multiple-choice questions at the end. Camilla used this in a couple of different ways – one time she showed the video to the class and then gave the students questions to answer in the same mode. Most times, she had the students find the video for themselves and then report back to her what they got on the final quiz. She would give the students the option of English or Spanish tutorials when she had the opportunity. She also encouraged them to view each tutorial video multiple times, and take the quiz several times, in order to get the most from the experience.

Another difference was that all three of Maggie’s classes that I observed had open-ended projects. In the first instance, one group did a research project on explorers, while another group did a similar but more simplified project because two levels were merged on that day. The second project I viewed was a script produced by the students; and the third required the students to collaborate to record a video. And while these activities were similar in that they were project-based, they were also different in that the last two were collaborative. This kind of collaborative project is something that both Martina and Camilla had less success doing. However, it is important to keep in mind that the two classes with the collaborative groups were higher level language use students.

One final difference among the teachers has to do with the inexperience of Maggie as a teacher. At the beginning of the study she refused me access to one of her classes because she thought I might be a distraction to the students' participation. Eventually she did say that I could view the class, but it was later, and I did not actually get to do it. As she was an inexperienced teacher, my immediate assumption was that Maggie was not in command of this class and did want it to get further out of control by my presence. Her challenges of management also seemed to extend to the use of technology, where she was not in command of: (1) the use of *YouTube* in a bandwidth challenged classroom and (2) a student using *Achieve3000*, while she should have been doing something else. While teachers at times have challenges with management, just about every one of Maggie's classes had some instance of this, and she was the only one who did not manage the issue in at least these two instances.

Perceptions of students

Another potential to affect the differences in teaching would be teachers' perceptions of students. This section will provide a discussion of the four teachers' perceptions of students and how these may have influenced their use of iPads in the classroom. Mostly, Camilla and Maggie have the most positive perceptions of students. Camilla has a somewhat less positive view, as she sometimes sees some students as barriers to teaching the class as a whole. Peter also has some less positive views, sometimes describing his students as being challenged, especially with their use of technology.

Camilla and Martina. Camilla and Martina did not share the same perceptions of students. Martina was concerned primarily with her students' agency with regards to

language and technology use. However, when some students interfered with other students' agency, she was quick to discuss students in terms of the challenges and barriers they provided to her teaching or other students' learning needs. And, along with considering her lower level language use students, she may have underestimated their abilities in terms of the kinds of activities they could accomplish. These challenges sometimes were simply in understanding the content she was trying to teach and students' lack of prior knowledge. However, overall, her view of her students was positive, with a focus on their ability to learn, to learn to use English, and to use English to learn the content of the course.

Camilla also described the challenges of working with low language use students. In one instance, she discussed her challenges with a student who wanted to express more, in a way which sounded like Camilla might be limiting his production. She did not actually talk about restricting him, she presented it as a way of making the presentation more manageable for him while saying that this particular student spent a lot of time on a specific activity. It seems that Camilla was trying to get the student to do basic formulaic language structures first, before he went on to do more challenging and productive activities. She had him start simply so that he would get something done in the time he had. Task completion was a challenge, as the student clearly wanted to produce language which was of a higher level of complexity (what most of his peers were doing), while being limited in the time he had to do this task.

Camilla further described that there were several of her students who were more likely to copy language than produce it. She tried to support her students by providing models, but as it was difficult as she was in her first year teaching students with a low

language use level. Teaching mathematics and science was also new to her, and she was not always sure what the students needed. There are a lot of potential caveats above, but perhaps the next is the most significant.

A good example of how students created language products was when they tried to use *Google Translate* to support their English language. They would type whole sentences into *Google*, and then copy and paste the resultant English phrase. So, here, encouraging them to work within modeled responses probably helped their language use more than copying and pasting sentences which they did not understand how to form, and may not have even been correctly formed sentences generated by a computer. Camilla, like Martina, talked about how there were different levels of language use within the group of newcomers in her class. She did not seem to have the luxury that Martina and Maggie had, in that their classes seemed to be split more by language use than by grade, so she explained how she would encourage participation from her lower language users by giving them something they could do – like identify a color or image on the screen.

And while in the aforementioned instance, she seemed to be trying to limit her students' production (possibly with good reason), she did not let labels of their literacy or language use have a negative impact. For example, her “illiterate” student seemed to be able to use text features like headings to find key elements of a description of an animal for her research project. Apparently, working closely with her student Camilla was able to get the student to produce some original written sentences, which made her rethink the student's “literacy”. She also pushed her newcomer students to view the *BrainPop* videos in English rather than the more comfortable Spanish.

Camilla was able to speak at considerable length throughout the study about the needs of her students, something she obviously thought about a lot. Along with discussions of the challenges she faced with meeting their needs, these showed how invested in her students she was. Her thoughtfulness, perhaps, was the biggest difference between the two teachers, providing Camilla with agency to work through her challenges, where Martina may have felt more fettered by them.

Maggie. Maggie was similar to both Martina and Camilla in that she struggled with the challenges associated with working with students who were at different levels. In fact, the first class I observed was when two previously separately leveled groups were mixed together. However, unlike Martina, she described this variation in terms of diversity, “a wider mix,” rather than as a barrier. Likewise, when students were challenged with typing on the iPads, she considered working through the challenge in terms of a benefit – a chance for the students to work on word processing skills. Also, rather than focusing on the challenges of her students, Maggie focused on their needs, telling me that she used her activities to support her students strengths and to help develop their skills such as in finding information on the Internet. She claimed to have spent time developing students’ strengths at other times, too, focusing on their needs, and helping them develop their own ideas regarding certain terms, for example “independence and revolution” in her social studies class.

Maggie’s developing language classes based on students’ needs seems to be a kind of *obuchenyie* for the classroom. She is focusing on the needs of the students and using that to guide instruction. It is hard, however, to know how successful was she. Just because she said she did something, does not mean that it worked. My observations of

her showed some success in her activities, though not all were completed when I saw them; however, from what I saw, the tasks seemed to be somewhat successfully completed, at least by some of the students. One or two observations do not indicate that all of her activities were similarly successful.

Peter. Peter was a bit more complicated to process, partly because he was reluctant to elaborate much on any of the questions I asked him. Perhaps because of my question wording, or because of his perceptions, he spoke a lot more about the challenges of his students than the other teachers, as well as indicated that they were low academically. While he did not dwell on this statement and he did focus on students' motivation to learn, it does indicate a perception that may be somewhat of a deficit perspective, focusing more on challenges rather than supporting students' strengths. Still, he did spend some time talking about how students were able to develop, and the abilities they had to use iPads (though he contradicted that at times).

Supports for the use of iPads in the classroom

There are many supports which are necessary to the use of iPads in the classroom, from infrastructure to professional development. However, one of the most important factors for teachers to be successful using a particular innovation, seems to be repeated and focused support using the innovation. This is supported by research (Egbert et al., 2002; Hegelheimer & Fisher, 2006).

Many of the physical supports which were discussed did not cause concern for the teachers during most of the study period. For the most part, when the teachers needed to use the iPads, they were available, ready and able to connect to the Internet. Internet connection was a challenge only for Maggie, as she was located in a temporary

classroom, a trailer outside the main building without a strong Internet connection. The other three teachers never had a challenge with this.

Availability was the only other concern, and this mostly occurred near the end of the study period and school year. The challenge for iPads was that there were more students than were “expected” based on how the school district makes plans for students from year to year. With too many students for the number of iPads, each school was challenged to create a solution for iPad use: Maverick allowed some students to do without, so that each teacher would have access to iPads for most of their students; Gran Torino reduced the number of groups the iPads were available for, so their newcomer students had one group of iPads for two groups of students.

The larger challenges were the supports that were provided for the intrinsic (second degree) barriers to the use of technology. The intrinsic barriers are based on the teachers’ perceptions of technology use, and their ability to create lessons which allow for students to be productive with iPads in the classroom.

As discussed in the previous sections, one of the main supports seems to be the ability of a teacher to adapt their teaching style to using iPads through the classroom through experience and practice. As the cases of Peter and Maggie demonstrate, it is not simply experience either in the use of technology or teaching which is important, but as with Camilla and Martina, teachers really need to have both. The interesting thing about this, is that only Maggie felt the need for further growth in the use of iPads in the classroom, which moved her to sign up for the professional learning community (PLC) on iPads, allowing her to get hands-on experience with using iPads in the classroom. For example, Peter felt comfortable enough with what he was doing, and perhaps would

continue to do the same thing going forward, as he expressed no overt interest in continuing to improve his teaching with iPads. In contrast, Maggie signed up for the PLC, and by the end of the school year had ideas for growing her use of iPads in the classroom, even if she ended up in the temporary classroom another year.

The difference between the two schools in the study is that Gran Torino had both a reason (with a new ESOL teacher – Martina) and a push for having additional training for the teachers, while Maverick did not have any organized professional development for that particular school year. Mr. Traeger talked about the idea of having “Tech Thursdays”, and how they had used the weekly training to share technological ideas in previous years, but these weekly voluntary sessions did not occur during the study period. In fact, Maverick Middle School did not have any professional development having to do with iPads at all during the study year. For these reasons, there did not seem to be any growth in those teachers (like Peter) who were more limited in their use of iPads in the classroom.

Other potential influences on the research

This research did not occur in a vacuum. There were factors which were outside of the researcher’s ability to control, which may have contributed to the success or may have caused mitigating factors influencing the research. These are outlined below in a discussion of the schools and the outside experiences, including the differences and similarities of demographics, atmosphere, trainings and other influences.

School influences on TPACK.

Demographics. The demographic differences between the two different schools are minimal. The student population is the same, even though the student body was not

supported by the same number of ESOL teachers at the different schools. Also, while there were different numbers of ESOL teachers, the teachers studied were teaching similar groups of students, with a similar focus on sheltering them in content courses which were taught with a language focus.

The similarities of the schools was, of course, part of the reason why the two schools were given the iPads, as both had a high proportion of free and reduced lunch students (Title I schools). However, the fact that the percentages of students in poverty (around 75%) and the percentages of Hispanic students (around 60%) is not unusual because it is likely that a large percentage of these Hispanic students are recent immigrants, and therefore with a large proportion in poverty.

I was unable to obtain exact numbers for the number of ELLs at each school. In addition, the schools treated the students differently in terms of service provided, so the numbers would not have been comparable. For instance, Maverick Middle School only provided service (i.e., had a dedicated ESOL teacher) for students who were classified as “newcomers” (approximately 70 distributed into two classes or cohorts by the end of the year), a subset of the numbers of what would be considered to be ELLs at Gran Torino (which also had around 65-70 newcomers by the end of the year). It is probable, however, with all the other similarities between the schools, that the numbers of students who would have tested into a higher level of ESOL might have been similar between the two schools. Still, my observations were within the same group of language use students – “newcomers”, and in that way the schools were very similar.

Because of the differences in the level of support provided to their ELLs, there was a difference in the numbers of teachers. At Maverick there were only two ESOL

teachers who were hired to work specifically with ELLs. I did not ask about the number of teachers directly, but I was aware of at least two other teachers, and thought there might be a third teacher as well – and I had the information from the webpage (which may or may not have been accurate). This difference did not have a significant effect on how the two schools operated, because the newcomer students in both contexts were taught by the two teachers in my study. Only Maggie was not teaching two sections of newcomer students like all the other teachers in the study. She had two sections of newcomers, and two sections of beginner students.

Atmosphere. Each of the schools has a similar atmosphere, which means that this factor has minimal effect on the study. Atmosphere, is related to how teachers collaborate and is an important part of Freeman and Johnson's (1998) context of school and schooling, and it provides an element of the teacher's professional identity and professional cognition (Johnson, 2015). How a teacher teaches and how students learn is not limited to the environment of the classroom. Teachers create policies in their classrooms based on how the administration decides to set rules for the school. How teachers coordinate and plan together and how well iPad management procedures set by one teacher are shared with others is a product in part of how administrative policies encourage teacher interaction and independence.

In one sense, the fact that both schools decided (at least initially) that none of the students from either school would be allowed to take the iPads home impacted how effective the use of iPads would be. Normally it would be advantageous if students were able to access their classwork at home, were able to use the same devices at home, and bring them back to school. With the iPads locked up in the schools, it became

challenging for students to access their materials when they were at home. Students could create materials that they could access with another electronic device through the web; students could print out their needed materials at the end of the day; or they could simply do without. However, the purpose behind providing Title I students with iPads was at least in part due to an expectation that these students would not have access to technology at home. (Maggie discussed this as the reason why she would not “flip” her classroom). Preventing the students from taking the iPads home defeated the purpose of the idea behind supporting Title I schools with iPads, because students would then be forced to do all their work at school. Still, there was logic in protecting the investment of the iPads and making sure that students did not become targets of theft when others discovered that they were bringing home \$500 devices every day from school.

In each school, I observed a level of camaraderie between the two pairs of teachers. This was important because in each instance the teachers were collaborating on the use of iPads and how to teach their students. At Maverick, Camilla and Peter were the only content area teachers for two groups of newcomer students which were mostly split by grade level (two groups which were primarily grades 6 and 7 and grades 7 and 8). The students would have other teachers for classes which were considered to be elective, but the four content areas (science, math, language arts and social studies) were shared between Camilla and Peter. At Gran Torino, there was a third teacher involved, as Maggie only taught the two groups of newcomers in social studies, while Martina covered their science and language arts classes. Still, there had to be a level of coordination between the teachers regarding policies for students and iPad use, something which Camilla talked about and seemed to take the lead on.

Policies that were created at each school were similar. Generally speaking, teachers decided that they should have a place for students to put their iPads when they were not in use. They also had to develop policies between the teachers as to whether they would allow the use of software like *YouTube* or *Pandora* for music when the students were supposed to be working independently. At Maverick, there was another challenge in that each of the teachers had one of the iPad carts, so they were dependent on each other for caring for the iPads used in two of their classes each day. Between Camilla and Peter there seemed to be a well coordinated plan for the use of the iPads – and I did not find any complaints between the teachers in regards to how they used them. For Gran Torino, the situation was a bit more tricky in that Martina had one of the carts, but since Maggie was out in the temporary classroom, she could not keep iPads out there, and had to have the students bring them whenever they were going to use them in her classroom. It also seemed as if there was some disagreement on policies regarding the use of applications like *YouTube*, which Maggie allowed but Martina frowned upon. Martina took it upon herself to try to institute a policy regarding *YouTube* use, although I did not hear about its result.

Another challenge at the schools occurred when they started running out of iPads, as the student population continued to grow throughout the year. For Gran Torino, this change meant that the iPads were now shared between the two groups of newcomers. The teachers had to coordinate when each person got to use the iPads, and eventually one person (the one with the iPads in their room) made the final decision. At Maverick, Peter and Camilla were not as manifestly challenged by iPad numbers and seemed to be comfortable with the idea of being somewhat short of devices, either because of new

students or students who had lost their iPad privileges. Either way, the teachers made their activities so that they could be done with paper and pencil as well as on the iPad. Therefore, Maverick teachers let the recently arrived students go without iPads while the other students used them.

Trainings. Trainings were provided to the teachers, in most cases, in the initial year of the iPad initiative. However, Gran Torino had two teachers during the study year who were not hired until after the initial year, and fortunately they were both provided with additional training through the PLC which Martina co-taught, as well as Apple trainings and trainings provided by the district.

Each of the schools had their own plans regarding trainings during the school year. Since this was the third year of the iPad implementation, training for teachers seemed to be a lower priority for the school year than it had been in the past. This did not mean that there was no training at either school, just that there was some level of frustration regarding the lack of training during the current school year at both schools, and it was especially evident where the teachers seemed to be in most need. However, new teachers could still attend “Apple” trainings and find out about specific applications which might be useful in their classes. Martina mentioned attending several of these events in the beginning of the school year.

In previous years there had been more trainings. At Maverick they had something called “Tech Thursdays”. The principal had not continued this in the third year, which limited his ability to move more teachers into the redefinition level (similar to advancing on Niess's (2011) TPACK growth scale – see Appendix B) on the SAMR scale (Puentedura, 2003), which was his goal. Neither Camilla nor Peter expressed any

concern about lack of training. Peter seemingly had a level of comfort with the technology, and Camilla pursued her own goals independently.

Gran Torino was a different situation: The teachers in the study at Gran Torino were less experienced in using iPads in the classroom, with one of them in her first year. The primary trainings offered by Gran Torino during the 2013-14 school year were the Apple trainings hosted in another state and Martina's PLC which Maggie attended. This training was provided by the district and offered to Martina and her co-instructor so that they could present this information to teachers at Gran Torino.

Overall, the trainings provided by each school during the year of my study seemed insufficient to the task of supporting new teachers and providing additional skills to those who were expected to become more proficient in using technology in their classrooms. Research suggests that more time and practice with a particular innovation will lead to greater acceptance and use (Egbert et al., 2002; Hegelheimer, 2006), and the lack of training is clearly a challenge. One could imagine how much time a teacher could spend on becoming comfortably trained in using iPads with their students, and I am sure many of them tried. Such continuous self-training would take away from teachers' personal and teaching time and is a challenge which relates back to Ertmer's (1999) first-order barriers to acquisition of technological expertise; despite years of research on technology, this primary barrier still exists. However, the teachers in this study made the most of what they had and managed to find ways to use iPads in their classrooms.

Outside influence on classroom activities. While there could be many different outside influences, the most interesting for this study seems to be the influence of the researcher. While the researcher was known to all the participants prior to the study, the

relationships between them were different. This difference may have influenced the teachers' perceptions of the researcher and the study itself. Teachers at Gran Torino seemed to be more influenced by their perception of the researcher, and were more prone to be influenced by my presence in their classrooms. The teachers at Maverick seemed less concerned.

In my role as an observer, the objective was to be as close to a neutral participant as possible. However, my role may have been closer to Merriam's (1998b) definition of an observer as participant than a complete observer, as my presence was certainly known to all actors in the classroom, and only disclosed to the students through the consent process. As my observations were generally planned in conversation (either face-to-face or via email) with the participant, and I wanted them to agree that I be there, it is not entirely clear whether the lessons were those initially planned or something special or a special day was chosen simply because I was going to be there. At least this was the situation with Maggie and Martina.

I feel fairly confident that Peter and Camilla did not modify their practices just because I was going to be there. Both seemed very confident in what they were doing in the classroom, and were only concerned with scheduling and if they would actually be present and that there would be no other distractions. Martina and Maggie were another matter. With Maggie, it was challenging to schedule a day, as she seemed more reluctant to let me come just any time, and two of the three times I came in for a project-based activity. Martina concerned me because she directly asked me if I liked her lesson. I did not want to be evaluative, and I told her that, but I also felt that I needed to reassure her that she was doing the right thing, because I did not want her to change. However, this

may have convinced her to show me lessons more like the original one, a demonstration lesson on how to use the technology.

My interaction with the teachers relates back to Merriam's (1998b) assessment that there are no neutral observers. As she states, "...participants who know they are being observed will tend to behave in socially acceptable ways and present themselves in a favorable manner" (p. 103). Martina's question was an attempt to be accepted by the researcher, and accepted in her teaching and use of technology in the classroom. Her need for reassurance was an indication that she was uncomfortable with being observed, and despite many assurances on my part, was not sure what I wanted to see, and felt that her teaching was being judged throughout. Maggie's seeming reluctance (or lack of communication with me to schedule meetings) may also have been an indication of my influence. These events indicate that there was at probably some perceived influence on at least Maggie and Martina, though I believe I had mitigated my influence on their activities at least somewhat through triangulation with the interview data.

Summary

Examining the data, there seems to be a correlation between the kinds of activities in which teachers engage and their previous experiences. This correlation would be indicative of the influences of their identity, agency and intentionality in planning and implementing lessons with iPads. In order to better understand this correlation, I categorized the subjects into three categories, based on their experience as a teacher and their digital nativism, as defined by C. Jones et al. (2010). This allowed me to categorize the teachers into these groups: young experienced teachers (Martina and Camilla), older experienced teachers (Peter) and young inexperienced teachers (Maggie). While all the

teachers seemed to have similar perceptions of teaching, they seemed to vary more when discussing their perceptions of students or their perceptions of using technology in the classroom. Martina and Camilla had similar perceptions of students, with both challenged by the language use their students had, but seemed to have a slightly different focus for how to resolve these challenges. Indeed, the teachers had diverse views, as Martina considered everything as more of a barrier, while Camilla problematized the challenges as the need to assist her students and find new ways to support their language learning. For her part, Maggie seemed to value the diversity of learners the most, and tried to find ways to support her students strengths more, while Peter struggled to focus on positive aspects of his students when discussing them.

Martina and Camilla also seemed to have very similar attitudes towards the use of technology in the classroom. Each had the goal of using technology with a purpose in the classroom, and to have students using technology in well managed situations, as well as their other classroom activities. Maggie, with her experience with technology, was also looking for more purposeful use of technology but her management was not always as well planned. Peter did well with managing his students and seemed to have a good concept for what he used the technology for. His purpose for using technology also seemed to support active learning. However, Peter's technology use was more in keeping with teacher-centered activities, especially skill and drill.

Each of the teachers was guided by their own perspective on technology and its use. Peter wanted to support his teaching; Camilla, Martina and to some extent Maggie, all wanted to use technology as another tool to allow students to be more productive in their language learning.

The supports that are necessary are related to the infrastructure, and these (for the most part) were well supported during the study period. Other supports related to intrinsic factors include in-depth and prolonged development of TPACK for the use of iPads in the classroom. Teachers can acquire some support for using iPads through previous experience teaching with other kinds of technology, however those who just have experience teaching and/or using technology may require more hands-on support to develop their capacity for using iPads in the classroom.

The schools were very similar, and administrators at both decided that keeping the iPads at school would be best for the students; however this made it difficult to use the iPads for long term projects or to store notes that students would need to take home. In each situation, the teachers seemed to work well together, despite challenges associated with sharing iPads for the groups of students they shared. This camaraderie allowed the teachers to share ideas for using iPads in the classroom, as well as procedures as to how to manage the iPads in their respective classrooms. And while each school provided some professional development, either during the study year, or in prior years, there did not seem to be sufficient support during the study year for any new teachers, although Martina attempted to change that at Gran Torino. The teachers at Maverick did not seem to see the need for training during the year.

Finally, it is possible that my study had an impact on the teachers in how they both represented their teaching and the activities they chose to show me. I am less inclined to think that either Peter or Camilla were influenced by my presence, though Maggie and Martina both seemed to indicate a possibility of either choosing days with interesting activities, or adapting their class to what they thought I would want to see.

In this chapter, I analyzed the data that was reported in Chapter Four, through the lens of teaching experience, and experience teaching using technology and more specifically iPads in response to the research questions. In Chapter Six I will conclude my research with a synthesis of this analysis and implications for practice and further research.

6. Chapter Six: Conclusion

In this chapter I will consider findings which relate to the use of iPads by Martina, Maggie, Camilla and Peter. I will also look at any findings which relate to the conceptual framework. I will start with those findings which are specific to my research questions. I will also examine other findings which are relevant to the study, but may be a result of my categorization of the teachers' teaching or technological experience. After looking at the findings, I will examine any limitations to the research. Finally I will explore implications both for further research and for teacher education.

Research Findings

In examining my research findings, I will start with the research question:

1. How do teachers of language learners use iPads in their classrooms?
 - a. How do teachers' perceptions of 1) teaching, 2) technology, 3) using technology and 4) their students shape the way they use iPads with English language learners?
 - b. What supports facilitate the use of iPads for instructional purposes in second language classrooms?

Based on the research questions, I will break the discussion up into two segments: first the four types of the perceptions of the teachers, followed by a combined perceptions section; and then the supports needed to effectively use technology in the language classroom. As they are intertwined, I will discuss technology and teaching with technology together.

Perceptions. The perceptions of teachers and the idea of teacher perceptions are closely related to identity. Teacher perceptions are deeply embedded in the experiences of the teachers, something which is related to Johnson's (2016) discussion of experiential knowledge and the prior experiences of teachers and how they relate to teacher identity (Pennington, 2015). How teachers use these perceptions to focus their instruction and relate them to their understanding of disciplinary knowledge (Johnson, 2016), as well as research related to effective teaching practices are an important part of this study.

For teachers to simply have the understanding and disciplinary knowledge of what is needed to teach in the classroom was insufficient for a teacher to be able to use technology, or in this case iPads, in the classroom with the greatest effect. Simply having enthusiasm (which all the teachers had) was insufficient. Of primary importance was the experiential knowledge of using technology in the classroom in combination with these perceptions and positive attitudes. In my findings I will relate what each area of perceptions brings to my understanding of the needs of teachers for having improved use of iPads in the classroom.

Teaching. The perceptions of teaching were similar for most of the teachers. All of the teachers hoped to improve their students' skills in language use. They each, however, had a different focus: Maggie emphasized getting students to be more academic; Martina wanted her students to be self-sufficient; Camilla was focused on herself, but wanted to facilitate her students learning; and Peter sought to make his students successful. These perceptions are guided by their philosophies which were derived from their identities as educators, and the perceptions guided many of the actions the teachers chose to take.

The activities that teachers choose, whether with or without technology, are guided by their identities as teachers, and their cognition of the purpose for teaching in the context of the classroom. Teachers could use activities which support their perceptions without using technology, even in an iPad school, or they could use similar activities with the iPads. And while there are differences between the two pairs of teachers – Camilla and Martina and Maggie and Peter, these do not seem to be as a result of their perceptions of teaching (which for at least Camilla, Martina and Maggie are very similar). Also, while all teachers are looking to improve their students' language abilities, they all see the benefit of using project-based learning activities. With one exception, this is supported by the observations of classroom activities.

Therefore, the only difference in teaching with iPads which might be traced to teaching perceptions would be Peter's focus on skills based activities. Although he talks about using project-based activities, he apparently does not use them very often. All the other teachers were observed using them on at least a semi-regular basis.

Technology and technology use. Another strong indicator of technology use, and more specifically iPad use, would be the teachers' perceptions of iPads and their use in the classroom. In order to get teachers to use technology in the classroom on a regular basis, it is important that they have a positive perception of the technology itself. This seems a reasonable assumption, which would be supported by research in technology (Ertmer, 1999) and research on language teacher education around the activity of teaching and learning (Freeman & Johnson, 1998) and teacher identity (Pennington, 2015).

Since all of the teachers in this study had a positive perception of iPad use (with minimal exceptions by Maggie and Camilla), and all of the teachers used iPads on a regular basis, this seems to be supported by the current research. Camilla was of the opinion that iPads were useful, but only where their use was merited – she did not try to force their use. Maggie was of the opinion (at least initially) that *Chromebooks* would be of better use for her students, but she was starting to discover other uses by the end of the study as a result of the Professional Learning Community she attended. It also seems, that while this perception should be considered important in general, it does seem to have affected whether teachers would use iPads in their classroom in the context of this study. They all wanted to use them, at least some of the time, and they did.

However, more important seems to be the perceptions of technology use. This idea is not so much about if they wanted to use the iPads in the classroom, but how they wanted to use them. All of the teachers talked about different kinds of project-based activities which they could use in their classrooms, but the difference was made clear by taking into account their individual purposes. Martina had a focus not only on using technology to assist students to develop language skills through projects and language use activities, but she also talked about how technology could be used to developed scientific skills, through skills-based applications. Camilla and Maggie had a strong focus on project-based activities, but even Camilla had some skills-based applications which she thought were appropriate to learning the skills of mathematics and science. These differences for Camilla and Martina in how they use iPads for science and mathematics versus their use with language applications is interesting, and I will talk more about this later.

Peter, on the other hand, did not have such a focus on his perceptions of the use of iPads. He perceived that the iPads would be greatly beneficial to him in terms of his ability to present information (i.e., show pictures from *Google*), gather materials from his students (through the use of *Edmodo* and *Socrative*) and grade materials through applications which automatically calculated students' scores (like *The Rosetta Stone* and *Achieve3000*). His perception of the iPads to make managing his instructional work easier (e.g., collecting and grading papers) affected the ways he used the iPads in the classroom.

These differences between the teachers produced some varied activities, especially when you consider the differences between Peter (who had nothing observed in the highest rating student-centeredness for his activities) and the other three teachers who all had some activities rated as a “five”. The purpose for which a teacher uses technology is not derivative of the technology itself – it cannot be changed by the technology, except in how the technology might limit or mediate the activities which students can use in the classroom. However, in alignment with Zhao (2003), it is a matter of taking a methodology and applying it to the technology you have. Technology does not change teaching so much as it mediates it through technological means.

Students. A teachers' perceptions of students will influence how they interact with the students in the classroom. This relates back to teacher cognition, the perceptions of students, and the dialect between students and teachers in the classroom (Kubanyiova & Feryok, 2015). Generally speaking, all the teachers had a mostly positive perception of their students, with two minor exceptions. Martina sometimes viewed her lower language use students ‘misplaced’ in her higher language use classroom as barriers to the

other students' language growth. Peter had a mixed view of his students' abilities with using iPads in the classroom. At times he thought that they would all be capable, because they were young and saw this kind of thing all the time. At other times he considered their inability to use the iPads as a barrier to them doing things in the classroom. And while he talked about some of his students being 'unresponsive', his impression and perceptions of most of his students was positive.

It is interesting that while Martina considered newcomer students as a barrier to her higher language use students, Camilla considered these students more of a challenge to her teaching, which she rose to support. In Camilla's discussion of her lowest language use students, or even illiterate students, she tried to present them with activities which were project-based and challenging, but provided additional supports and a required they produce a lower level of product to require they produce. Instead of teaching the students all at the same level, she modified her activities to the perceived level of the student in question, giving them all similar project-based activities.

Overall, I do not believe that the teacher perceptions of students in this study had an effect on what the teachers chose to do for the classes they taught as a whole. For the most part, the teachers attempted to do challenging activities, or skills-based activities for other reasons than their perceptions of their students' skills with language or technology, with one exception. Most of the teachers did provide activities to support language skills whether they worked on project-based activities or not. I am sure that this is related to their perceptions of their students' language skills. However, while they provided support, this was not a limiting factor for most of the teachers as they still attempted to

allow the students opportunities to create and use language in productive ways. Peter talked about doing this as well, but I did not observe it.

Combined perceptions. Based on the perceptions of the teachers in this study, three of the teachers should have had very similar activities. However, the data does not support that Camilla, Martina and Maggie had similar strengths in using iPads in the classroom. Despite the fact that Martina was in her first year of using iPads in the classroom, she was able to develop more challenging activities with her students and was more comfortable researching and developing activities through her supports at the school and on the web. Camilla was especially comfortable with using iPads in the classroom, and as it was her third year, this seems understandable. I will further explore this in the next sections.

The singular difference that can be traced to perceptions of the teachers would be Peter. His perceptions of teaching and technology use are a strong indication of why his activities in the classroom were different.

Supports needed for technology integration. This section is about particular supports which are needed for teachers to use iPads in their classrooms. These supports include the development of their own support networks, professional development, infrastructure, and sufficient quantity of iPads. These are the supports which were most evident in this study; there are other aspects which were not as important to this study, which I will not list here.

In regards to development of a personal support network, it is clear from this study is that teachers need to be able and comfortable with this development. Both Martina and Camilla were comfortable with gathering together the many resources they

had at their disposal (peers, the internet, technology coordinators, etc.) to acquire the information they needed to be successful, similar to what Robb (2006) has discussed. Peter and Maggie did not have as much success with this. Or, perhaps Peter had had some success in the past and had now gotten to the point where he was comfortable with what he was doing. In contrast, Maggie clearly expressed the benefit of working with peers during her initial professional development, and was also able to use the professional learning community to develop ideas for her next session. She could find out how to use technology online, or through practice: her struggle was with integrating it into her lessons.

Without a well developed support network, teachers may become frustrated and develop a negative impression about technology in general, believing “it just does not work”. In line with Egbert et al. (2002) and Hegelheimer (2006), providing teachers with opportunities to practice using technology in teaching situations would be greatly beneficial to provide them with a level of comfort in a safe environment with the potential for feedback from peers and teacher educators.

Another aspect which this study showed was important was a robust professional development program. Neither of the schools had a program for their teachers when the school year started, but both Peter and Camilla had been through several sessions at Maverick and perhaps two years of support (e.g., the technology Thursdays which were discontinued in the third year). At Gran Torino, Martina, with another teacher, was able to develop a professional learning community (PLC) which covered many different aspects of using iPads in the classroom, including some innovative ways. The PLC was

of particular benefit to Maggie and provided her with peer interaction to assist with generating ideas to use iPads in the classroom.

While the differences in professional development are interesting, they do not show so much why the teachers are different, but indicate how to assist their improvement. In this context, Camilla became a leader in her school, and Peter chose to focus on the technology that he could apply his teaching situation. For Maggie and Martina, the training was more recent (more because they were newer to the iPad schools), with Martina going through training during the time of the study. And while Martina was just acquiring iPad training, she quickly took a leadership role in her school with using iPads, quickly supplanting Maggie's longer experience with using iPads to teach. Another indication of higher levels of TPACK according to Niess (2011) would be individuals' advocating the use of a particular technology for the classroom (see Appendix B). According to Niess, this is the highest level of TPACK, and both Camilla and Martina achieved this through their roles in their respective schools.

One support which should not have been so important was the wireless network which the teachers used to access the internet with their iPads. For three of the teachers this was not a factor, but Maggie had many issues with accessing the Internet and spent much of her time looking for alternate rooms within the building for better access. This could have been a learning experience for Maggie but it became a challenge which restricted her instructional situation at times, until she learned about some non-Internet applications during Martina's PLC. This first-order barrier to technology use (Ertmer, 1999) made it difficult for her to be successful and develop sufficient experience using the iPads.

Another way that the teachers were challenged through their lack of support from their schools, was through the number of iPads which they had for their students. This became a factor for both schools, and it is interesting how each institution attempted to deal with it differently. In Maverick, Camilla and Peter were able to continue with their policy of having some students use iPads, and some who did not. Gran Torino tried splitting the iPads between two groups of students, which meant that they did not always have iPads in their classroom with them, and the teachers ended up sharing as well – with the consequence that two of the teachers were not able to use them when they wanted to. Again, in this instance, a first-order barrier (Ertmer, 1999) is limiting students' access to technology, making it more challenging to be successful in its use, or to have more TPACK growth.

Overall, it was important for the teachers to have personal networks to work with in order to develop techniques for working with peers to understand how best to use technology in the classroom. All of the teachers mentioned taking advantage of peers to support their learning about new activities to use with their students in the classroom. The difference between Maggie and Peter and Martina and Camilla, was that Martina and Camilla were no longer dependent on learning from their peers, and they used it mostly as a secondary support, whereas Peter and Maggie needed it to gain the experience of teaching with iPads that they were lacking. Experience and age are somewhat interrelated, as I suggested in Chapter Three, and I will discuss that more in the next section.

Additional Factors

There are several factors which are related to my study which were not a part of my research questions. The first is the age and teaching experience each of the teachers had, which I used as a way of developing my cases explained in Chapter Three. A second is the use of the technological, pedagogical and content knowledge (TPACK) framework. Since I was exploring technology use, not knowledge of the teachers, using a knowledge base framework is a little beyond the research questions, but it helped me organize my study and I was able to get some interesting information from the study related to the framework. Third, while working with the TPACK framework [which is relatively new, and recently criticized (Brantley-Dias & Ertmer, 2013)], I was able to have some insights into the framework's usefulness and challenges. In this section, I will discuss some insights regarding the study in terms of the differences between age and technological experience, one particular teacher's TPACK, and my other insights on TPACK.

Age, technology experience and teaching experience. An important aspect to this study is the importance that experience teaching and working with technology affected the use of iPads in the classroom. In Maggie's case, she was a teacher who was the only clear "digital native", yet she came to the classroom with challenges in using technology for instructional purposes. She had several activities, but they took large amounts of her planning resources to implement, and that is without consideration of the challenges with working in a classroom with an inconsistent, or a consistently bad, Internet connection. Simply because Maggie is a digital native does not make her an

expert in using technology to teach; she faces the typical challenges that any new teacher has, and these are not limited to her classroom management without technology.

Camilla and Martina are, according to C. Jones et al. (2010), on the edge of being a digital natives. However, Prensky's (2001) original idea of the digital native had to do with exposure to technology growing up. So, the exposure Camilla and Martina both reported growing up was probably important to their ability to adapt teaching to using technology, and in this study, iPads in the classroom. Because of their experiences before teaching, and the years of experience they had teaching with technology, which both reported, they were able to adapt to new situations for the study school year, keeping the use of technology as a part of their practice. This is important especially because Martina was working in a new school with iPads for the first time and Camilla had never before worked with newcomer students, adding to their challenge.

Martina's experience is also interesting, because she was the newest teacher in the study in using iPads, but she also had years of experience in teaching with technology. She started out asking her peers a lot of questions of her peers and attending a lot of different training sessions. She ended the year as an advocate for how to use iPads in the classroom. And while Hubbard (2008) suggested changes in technology would incur additional challenges in its use, and this may still be true in some cases, I think Martina's experience contradicts Hubbard's notion in that she was able to take a lot of her experiences in working with laptops and apply it to working with iPads. In fact, she did better in this than the "digital native" Maggie, because she was able to think more like an iPad user than a laptop user when planning her lessons than Maggie was.

TPACK of Camilla. Most of the data collected did not allow me to conduct a true investigation of the TPACK knowledge-base because it only allowed me to focus on technological use, not the knowledge of that technological use and how the teachers were able to make decisions regarding its use. However, it was possible to glean some insight into Camilla's depth of knowledge regarding the use of technology in the classroom. Her knowledge came to the fore because she was able to talk in considerable detail about not only her thought processes relating to what she was currently doing, but also what her thought processes were during many other points in the process integrating iPads into the core of her teaching. This clarity of thought came through as she related experiences that formed the tapestry of her identity as a teacher struggling to find the best solutions for her students in a classroom where using iPads was not always appropriate. Freeman (2002) suggested that there were many vantage points to probe teacher knowledge, including prior knowledge, rationale for current practices, and many other aspects of the teacher's identity that come into the context of the current situation. For Camilla, many of these frames of teacher expertise were explored in great detail not only in my initial interview, but during most of the post-observation interviews as well.

The discussions which led to Camilla's interpretations of her own knowledge showed an interesting insights into the levels of her own TPACK and its importance in being able to make decisions in the classroom using iPads or other forms of technology. Her guiding philosophy for when and how to use technology was to make sure that it was purposeful. This was clearly related to many of her decisions, but most expressively put when she discussed why she was having a conflict with her principal over the observation of her use of technology: his concern was that she was not always using the iPads on

days when observers came into the classroom. It was also expressed in her struggles with her students using iPads collaboratively and trying to get them away from the overuse of *Google Translate*. In each case, Camilla expressed what she hoped to accomplish, what she knew about her students and their abilities, and their needs for future assessments, and what she did not know about how to remedy the situation.

The other teachers did not have the same kind of insight. Martina did not really espouse any determination to follow her own principles, as she was willing to change her whole class so that I would not have to go home on a particular day, though she did at times refer to purposeful use of technology. Maggie, neither followed any principles nor seemed concerned about what I would observe, at least on the days when I was there, allowing her students to make decisions about when it was appropriate to use technology. Of the three days I observed Maggie, I only saw one of the activities which were “planned” iPad uses, and that was the final observation. Peter did not have any particular philosophy or concern and just followed his regular procedure for whatever situation came up. None of aforementioned three teachers expressed their understanding about why they were doing a particular activity in the classroom with the depth that Camilla did. This level of difference between Camilla’s ability to express her understanding and knowledge regarding the purposes for her classroom activities I believe shows an increased level of TPACK more clearly than any examination of their technology use per se. Still, a deeper examination of each of the other three teachers’ purposes and understanding of their use would more accurately facilitate the understanding of their knowledge as it has done with Camilla.

For this reason this research does not have a lot to say about the TPACK of the teachers involved in the study. The exploration does, however, offer some insights into the paradigm itself, which will be discussed in more depth in the next section.

Beyond TPACK. The single knowledge component of the TPACK framework, TPACK, is technological knowledge based on teaching in a specific content area. This notion is supported by my research. Martina and Camilla, who both worked in dual areas of content (teaching language with another content area) and demonstrated differences in the use of technology dependent on the content goals of the activity, are examples. The rest of the knowledge components from the framework, while useful, may complicate how we look at teacher knowledge. So, the purpose of the research or practice made it clearer that, while the usefulness of the TPACK framework has benefits in examining discrete portions of technological knowledge there are some drawbacks and another way of looking at technological knowledge as it relates to teaching a content area would be more useful: e.g., limiting it to one aspect of TPACK, rather than focusing on all the other aspects of the knowledge framework (technological content knowledge, technological pedagogical knowledge, and technological knowledge). The idea of TPACK having a content focus is a rationale for why computer assisted language learning (CALL) exists, and why there is a need for research on how to teach using technology in language learning classrooms, as well as how to educate teachers in this use. However, the TPACK framework is challenging to work with, as I have already discussed, and as Brantley-Dias and Ertmer (2013) explain in some depth. And there are many challenges to using it for a conceptual framework.

While there are increased complications from the addition of four more areas of knowledge to Shulman's (1986) pedagogical content knowledge, this research has discovered that the specificity of this knowledge has important distinctions in practice. In this context, the idea of technological pedagogical knowledge manifested itself in terms of how teachers managed the devices. This management included: what should students do with iPads when they are not using them – should they keep them face up, or turn them face down, or put them in their desk (potentially using them secretly); whether or not to allow the use of *YouTube* for listening to music when the bandwidth of the Internet is at stake; how iPads would be shared between the teachers when they ran short – should they share them using class by class, or should they limit their use to those who had them before new students came – who actually gets to use the iPads and Martina's choices regarding software for writing, and the overall challenge for finding “free” software that students can use, even though it has been limited – what limits are ok, and which ones will make it difficult to achieve the overall objective, in light of other restrictions (like numbers of iPads and sharing).

Technological content knowledge is much harder to discern within the context of a teaching situation. However, in my conversations with Martina she told me about her search for the ideal application for use in language classrooms. In attempting to get her students reading materials, she attempted to get the *Nook* application to work for all of her students, under her password – which failed spectacularly. Here she used some of her technological content knowledge about reading a book using a mobile device. She applied it to a teaching situation without considering the ramifications of how all of her class logging in to her *Nook* account at the same time would function.

The TPACK framework exhibits a way of describing these differences in a way that provides some insights. The problem comes when trying to do too much with the framework: trying to create a way of evaluating TPACK within the entire framework of technological content knowledge, technological pedagogical knowledge, technological knowledge and all the other knowledge areas in the framework (see Appendix C). Perhaps it would be useful to discuss classroom activities in terms of the different knowledge forms presented in the framework: If this teacher is struggling with managing his students with using the iPad, he needs to have some support with his technological pedagogical knowledge. The seven different elements, and many different content areas, make it difficult to find one overarching way of evaluating the knowledge that these elements represent, as Brantley-Dias and Ertmer (2013) have suggested.

Limitations

One limitation of this research is the small sample. Therefore, the burden of generalization is the reader's responsibility, ensuring that the similarity of the cases is sufficiently similar to other cases which need comparison (Firestone, 1993a).

A second limitation would be related to the way that the activities are measured. In a study of high quality teaching, Valli et al., (2004) created an application which allowed the researchers to measure many different aspects of teaching, happening at discrete points during the teaching application. This allows for numbers which are easily quantifiable, and provides an easy way to compare one class with another class, despite the length of time the class spends on a particular activity. I chose instead to measure activities individually, which means that an 82-minute activity was counted only one time instead of, for example, measuring that same 82-minute activity 17 times at five minute

intervals. If I had conducted time sampling, measures of activities for each of the teachers would have changed, in some instances dramatically. Some activities might not have been counted at all if they had been less than 5 minutes in length, while others which were longer in nature, might have been counted multiple times. I chose to use the data I had as a part of a rich description of each class, rather than an attempt to quantify it in terms of the minutes and seconds of each activity, allowing the texture of each supporting activity to come through as students were taken through their learning goals. This data, therefore, provides a richer description of the activities, which allows the reader to see more of what was going on.

Another limitation of this study is the ability of my research to describe what happened in any classroom beyond the time I was there. This limitation is especially important in terms of the small number of times I visited Maggie's classroom. Additionally, challenges like snow and testing certainly influenced how much access I had to classroom observation. With only three visits to Maggie's classroom, I still have questions about what was happening there most of the time.

Implications for further research

There are several areas from this study which are worthy for further consideration. These items are beyond the scope of the current study, but may have implications which can be explored in other research.

Technology use in different content areas. As I have indicated, teachers who were teaching students in sheltered content classrooms may have dual versions of TPACK. Martina expressly discussed teaching science as different from teaching English. Similarly, Camilla who had more time teaching in the content areas (and not

teaching any language classes) would also often have special applications (*Geoboard* for example) which were used for skills needed in the science or mathematics classroom, although she did have product-based applications for working on linguistic goals. Peter and Maggie taught language and social studies, and they seemed to teach them in the same way as Martina, focusing on language production. And, there is no evidence that either Peter or Maggie explored social studies skills-based applications in their use of technology in their classrooms, and I did not think to ask them about this at the time. A broader study, with experts in multiple disciplines and their use of technology in classrooms would be a useful addition to the research base.

Normalization of TPACK? It is possible, as Bax (2003) has suggested, that there will come a time when technology will be normalized. Normalization is the idea that technology will become so much a part of our lives, that it will be second nature for students and teachers to use it in a productive way. Martina's experience almost leads one to believe this, as her comfort with the use of iPads in teaching is derivative of her use of computers with teaching in previous teaching situations. As such she did not need as much training using iPads for teaching; understanding the applications and becoming familiar enough that learning one use of iPads in the classroom leads to expectations for others. If technology use in the classroom becomes similar enough that teachers have enough understanding from their own learning experiences, (i.e., the teacher as learner) the integration of similar future technological innovations will seem recognizable enough that picking up some new innovation will be a matter of plugging it into their existing framework.

Hubbard (2008) suggested that technological change will always be sufficiently different that educators will not be able to keep up with these changes as they occur and, therefore, research and training will have to focus on how teachers need to adapt, to acquire the skills needed and to apply them to their classroom. Research by both Cox and Graham (2009) and Brantley-Dias and Ertmer (2013), however, suggest the possibility of such a normalization within the TPACK framework, at least in terms of older technological innovations. Further research is needed on how generational differences are influencing changes in attitudes and expectations toward the use of innovative technology in the classroom.

Understanding teacher education's effects on TPACK. None of the respondents reported receiving any training in the use of technology from their teacher education programs – with the exception of Maggie who reported some training only from her mentor teachers during her internship. This is consistent with previous research which has discussed the challenges associated with CALL training in language teacher education programs (Butler-Pascoe, 1997; Ertmer & Hruskocy, 1999; Hong, 2010; Hubbard, 2008; Kessler, 2006; O'Dowd, 2015). However, in the current study it is not clear if the teachers' indications of their technological training is entirely related to inadequacies of the teacher education programs they attended or a perception of the programs being inadequate. My goal was not to evaluate each teacher's understanding of his/her teacher education program, but to find out how their teacher education programs had prepared them, and their perceptions may cloud the actuality. However, while this question is still in doubt, there remains a reason to research the current state of practice for teacher educators and training teachers to use technology in the classroom.

Why teachers leave innovative schools. One aspect of this research project which was not addressed is what happens when a teacher is opposed to a technological innovation – or its use in the classroom. As Mr. Traeger stated in his initial interview, teachers who were not interested in using iPads in their classrooms were encouraged to leave the building. Indeed, Engeström and Sannino (2010) have suggested that one of the challenges of consolidating new practices is countering resistance to the new practice and getting all interested parties to buy into it. Allowing teachers to leave, and encouraging interested parties to join in is just one way of making a new practice more successful. Research should explore if and why teachers are resistant to technological innovations and integration into teaching as a part of new practices at a school.

Implications for teacher education

Much of the research which I have examined has discussed the challenges associated with training teachers in using technology (Butler-Pascoe, 1997; Hong, 2010; Hubbard, 2008; Kessler, 2007, 2010; Kessler & Plakans, 2008; O’Dowd, 2015; Oxford & Jung, 2007). According to the participants in this research project, none of them claimed to have any support in using technology in the classroom from their teacher education programs, at least in the program itself. From this challenge we can judge teacher education programs in one of two ways: (1) there was no support for technology education for the teacher in question (which may be likely especially for the older teachers) or (2) there was no perceived assistance for the teachers during their teacher education programs. Either way, teacher education programs need to do better to assist their students to become more aware of the possible choices for using technology in classrooms. As Hubbard (2008) seems to suggest, it is essential to make sure that teacher

educators prepare future teachers to develop technological competence beyond both their own current knowledge of themselves and that of their professors.

From the experiences of Camilla and Martina, we can see that those teachers with experience in both using technology and teaching are the most comfortable with combining the two. This notion would seem to support the idea of the TPACK framework, that is, the idea that there is more than just a combination of technological knowledge and pedagogical knowledge, but experience with using these in practice [e.g., moving beyond Shulman's (1986) idea of propositions, and using his ideas regarding case and strategic knowledge]. In that instance teachers need to develop their teaching skills both pedagogically and technologically in their practicum and beyond in order to be successful. In addition, considering the idea of digital natives (Prensky, 2001) and the notion that teachers learn better with more exposure to technological innovations, (Egbert et al., 2002; Hegelheimer, 2006) suggests that while teachers may come to their profession with technological skills, they will need clearer and more consistent integration of technological pedagogy within a content area.

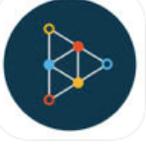
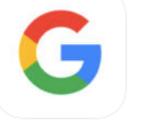
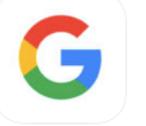
In his discussion of how we prepare teachers to teach for forty years of innovations, Hubbard (2008) crystalizes one of the biggest challenges for this kind of preparation – that those who are preparing teachers have even less personal experience with technology than their students. Often teacher educators are many years removed from their own teacher education programs, and during this time many kinds of technological innovations have developed, many which teacher educators are not as aware of or comfortable with. For teacher educators to be effective, they need to find

some way of preparing teachers not just for the technology of today, but to stay current with the technological innovations of tomorrow.

Appendices

Appendix A: Various iPad applications and other hardware and software

Application	Description (Category (Means, 1994; Murray & Olcese, 2011))	Image
Achieve3000 (TeenBiz)	Literacy based web/mobile application which creates/deploys articles/stories with multiple lexile levels with comprehension questions (tutor)	
Aurasma	Mobile application for Augmented Reality, which allows for linking a picture of a physical item with some augmentation (i.e., a video) allowing users to ‘scan’ the item to find the augmentation (tool/communicate).	
BrainPop	Tutorial web page which have video demonstrations on many different topics with a quiz at the end (tutor).	
Build-a-Body	Mobile application which allows for users to place parts of body systems in the right position (skeletal, circular, respiratory, etc.) (tutor).	
Chromebook	Mobile device/laptop which is designed to run a web based operating system which can run without the Internet.	
ClassDojo	Mobile device application which teachers can use to encourage positive behavior in one or more areas of class participation (tool).	
DropBox	Web based application which allows for the sharing of files remotely through folders which are located on the web, accessible through applications or the web (tool).	
Edmodo	Web based classroom management system which can be a repository for documents and allows for the generation and grading of online quizzes, among other items (tutor, tool).	

EduCreations Interactive	Mobile application which allows the user to create a document with screens like presentation, and allows for typing, photos, clipart, drawing/writing, and audio.	
Edusoft	Web based application used to store student test data, which teachers have access to.	
Excel	Computer based application (moving to web and mobile) for creating spreadsheets (tool).	
Facebook	Web based application which allows for users to network with their peers around the world, through updates, instant messaging, sharing of photos, tagging, and 'mail' (communicate).	
Google	Web based search engine, as well as a company with many different web based applications (see below) (tool).	
Google apps	Many different kinds of web based applications which are available for Google users, including Google Drive (see below) (tool)	
Google Chrome (OS)	Operating system for Chromebooks (see Chromebook). Also a cross-platform web-browser on which the operating system is based.	
Google Drive	Web based office application suite, including a word processor, spreadsheet, and presentation application. Also used to store virtual documents online in Google format, and in other formats (tool/communicate).	
Google Maps	Web based/mobile application which allows user to locate a street address and navigate to the location. Also has the ability to view a location in '3 dimensions' through rotating the view of flat images (tool).	

Google Translate	Web based application to translate words or phrases from one language to another (tool/communicate).	
iLife	Suite of mobile/computer applications which include video and audio production (tool/communicate).	
iMovie	The movie portion of the iLife suite, a mobile/computer based application which allows for the creation and editing of video and audio (tool/communicate).	
Instagram	Mobile/web based application which allows users to share pictures which they have taken/created on the web through peers, or generally (tool/communicate/collaborate)	
InstaGrok	Web based/mobile application which assists users with finding information and media related to a particular topic. Users can find information based on different language levels (explore/tool).	
InterWrite	Interactive white board hardware which allows for control of a computer through touching a whiteboard which the computer screen is projected onto (tool).	
iWork	Mobile/computer based office suite of applications, which include a word processor, spreadsheets and presentation software (tool/communicate).	
iXL	Web based application which has tutorials on mathematics and language, for many different grade levels and abilities (tutor)	
Kahoot	Web based/mobile application which allows users to create a multiple choice quiz/game for other users to enter and participate competing for who answers the most correct answers.	
Keynote	Part of iWork suite, for presentation software (tool/communicate).	

Moodle	Web based classroom management system which can be a repository for documents and allows for the generation and grading of online quizzes, among other items (tutor, tool).	
Notability	Web based/Mobile application which allows for annotating postscript document format (.pdf) files and other file types (tool).	
Notes	Mobile/computer application allowing for the creating of small text 'notes' which can be shared (tool/communicate).	
Pandora	Mobile/computer web based application allowing the user to listen to music based on certain artistic choices made by the user which makes a 'channel' of similar music (tool).	
Pinterest	Mobile/web based application for users to share interesting items they find on the web through 'pin'ing the item (tool/communicate/collaborate).	
PowerPoint	Computer based application (which has moved to the web and mobile) for creating presentations (tool).	
Popplet	Mobile application which allows users to create popplets, which help organize ideas into a 'web' (tool).	
Promethean Boards	Interactive white board hardware which allows for control of a computer through touching a whiteboard which the computer screen is projected onto (tool).	
QR Reader	Mobile application which allows taking a screen shot of a square Quick Response (QR) code which is often a web address, and will interpret the code to take your browser to the correct address (tool).	

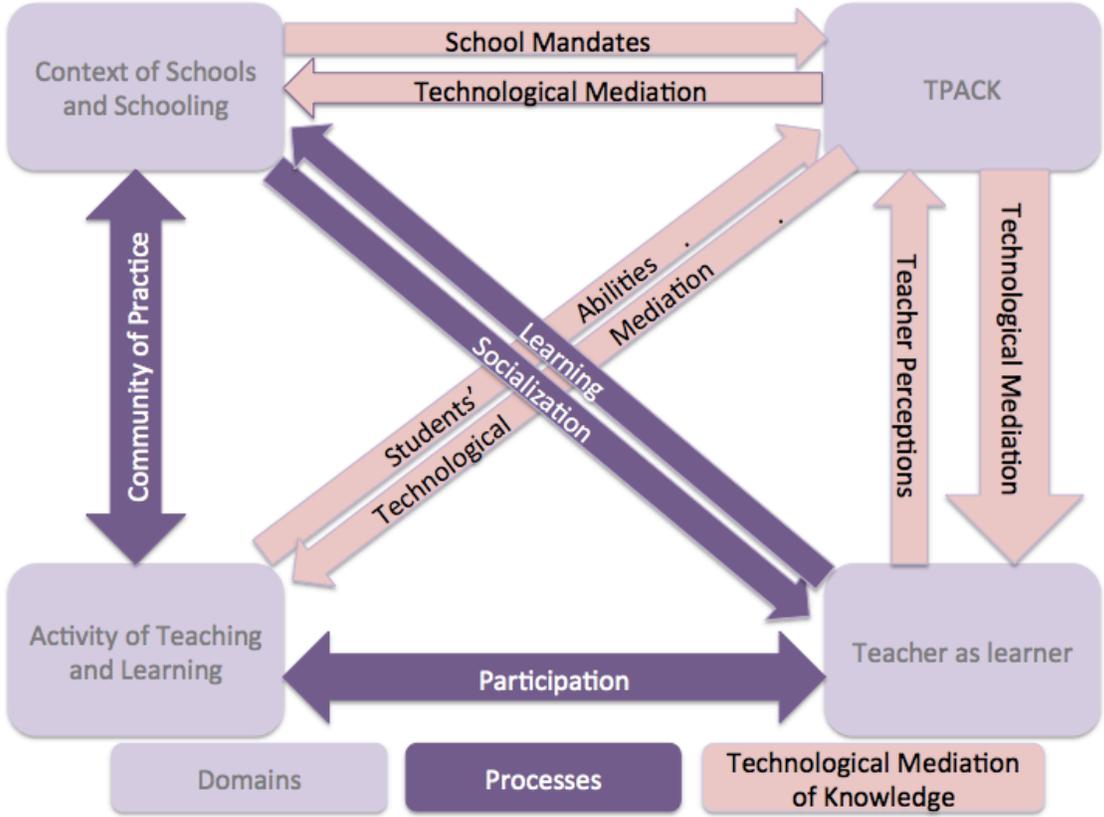
The Rosetta Stone	Mobile/computer based application which assists in language learning through the use of multiple choice quizzes (tutor).	
Safari	Web browser computer/mobile application which allows you to 'surf' the world wide web (tool).	
Skype	Mobile/computer application which connects you with other users to communicate via text, voice or video (communicate).	
SmartBoards	Interactive white board hardware which allows for control of a computer through touching a whiteboard which the computer screen is projected onto (tool).	
Socrative	Mobile based application course management system which provides teacher created assessments directed to students via a 'class' (tutor).	
StoryKit	Mobile application for the creation of 'storybooks' with a cover page, story pages with text, images and audio (tool/communicate).	
TeenBiz	(See Achieve3000).	
Twitter	Mobile/web based application used to communicate with peers or share information generally, usually in the form of very short messages and/or links (communicate).	
Viber	Mobile/computer application which connects you with other users to communicate via text, voice or video (communicate).	
Videolicious	Mobile application which allows for the creation of videos through use of camera, videos, audio and pictures (tool/communicate).	

WiFi	Communications protocol commonly used with computers and mobile devices – usually higher bandwidth than normal mobile connections, and may require authentication/ a user name to connect.	
YouTube	Web based/mobile application with a large repository of videos, a community to share, and the potential to upload and/or record videos to the web (tutor, tool, communicate).	

Appendix B: Niess (2011) TPACK Growth

1. *Recognizing* (knowledge) where teachers are able to use the technology and recognize the alignment of the technology with subject matter content, yet do not integrate the technology in teaching and learning of the content.
2. *Accepting* (persuasion) where teachers form a favorable or unfavorable attitude toward teaching and learning specific content topics with an appropriate technology.
3. *Adapting* (decision) where teachers engage in activities that lead to a choice to adopt or reject teaching and learning specific content topics with an appropriate technology.
4. *Exploring* (implementation) where teachers actively integrate teaching and learning of specific content topics with an appropriate technology.
5. *Advancing* (confirmation) where teachers redesign the curricula and evaluate the results of the decision to integrate teaching and learning specific content topics with an appropriate technology (Niess, 2011, p 312-313).

Appendix C: Combined Framework



Based on Mishra and Koehler (2005, 2008) and Freeman and Johnson (1998).

Appendix D: Observation protocol.

The goal will be to examine how the teachers put the iPads to use in their classroom. I am specifically looking for what activities are implemented by the teacher, how the teacher explains these actions to the students and whether the students then go right into the activity, or if there is a period of discussion – basically how the students respond to the activities. Also, I will look at the specific applications which are used with the device, and noting what is used and how it functions in the classroom during the lesson, will be a part of the observation. Time keeping is for the purpose of determining later how long activities took, and matching them up with audio recordings.

Time	Teacher Action/words	Student response	Device use/application	Analysis/initial thoughts

Appendix E: Administrative Initial Questions

1. How would you describe the teacher's use of technology in the classroom?
(please choose the highest rating that applies)
 - a. For individual work purposes
 - b. In teaching sporadically, mostly presentation style
 - c. Periodically, with some student work, though may be without real purpose
 - d. Regularly, with some purpose, and a balance of student-centered and teacher-centered use
 - e. Purposefully, with primarily student-centered work minimal teacher-centered.
2. How does the teacher share ideas about technology with colleagues?
 - a. May be passively listening
 - b. Actively listening, asks questions when told about something
 - c. Actively seeking activities to use in their classroom
 - d. Suggesting activities which they have found - searching on their own for classroom based activities
 - e. Advocating materials they have found and had success with.
3. How does the teacher engage in planning lessons?
 - a. Plan lessons then uses PPTs to share information with students.
 - b. Plan lessons and then look for some materials which may assist.
 - c. Choose goals, and then integrate activities into lessons as planned.
 - d. Find interesting technology and then think of goals/lessons which may be planned around technology

- e. Have several technological/pedagogical goals in mind and use series of classes/lessons to prepare students with activity/goals in mind.
4. How do you feel about being a part of this project?
5. Do you think this will be beneficial to your students in terms of their learning?
Why or why not?
6. What were your first thought in terms of planning and implementation of this project?
7. What have you done to implement this plan?
8. How do you think your staff feels about this project? What are some positive views, and what are some negative views? Why do you think they feel this way?
9. Who among your teachers do you think will be especially effective using iPads in their classroom? How about your Second language or TESOL teachers?
10. Who among your teachers do you think will struggle the most in the project?
Second language teachers? TESOL teachers?
11. What do you hope to accomplish this first year using iPads in the classroom?
12. Are there any challenges that you think might make this more difficult?

Appendix F: End of Year interview questions for Administrators

1. What were your goals for using the iPads in your school this year?
2. Do you think you accomplished these goals? Why or Why not?
3. How do you think your teachers liked using iPads in their classes?
4. What are you going to do differently next year?
5. What support did you receive for using iPads this year?
6. Would you change your method for investigating good practices for iPad use next year?
7. Do you still feel the same way about using iPads in the classroom? Why or why not?

Appendix G: Initial Teacher Interview Questions

1. What was your training in?
2. What is your general philosophy of teaching?
3. Did you have any technology integration training? Please describe it.
4. Did you feel that you were prepared to use technology in your classroom?
Why or why not?
5. Prior to this year, what kinds of activities would you do in your classroom that involved technology?
6. What was your first impression of this project?
7. Why did you feel that way?
8. Do you still feel that way?
9. Are you comfortable with using technology? Why or why not?
10. What do you do to make yourself more comfortable with technology in general?
11. How do you think iPads will help student learning?
12. What is your plan for using iPads in the classroom?
13. What are your personal goals for using iPads this school year?
14. Can you walk me through how you would plan a lesson using iPads?

Appendix H: Post Observation Teacher Interview.

1. What did you plan to accomplish in class today?
2. Did you accomplish your goals? How do you know?
3. How did you plan to use the iPads to assist you with your plan for today?
4. What concerned you most in planning for today's lesson?
5. Do you feel that they helped today? Why?
6. How did the students respond to using the iPads?
7. When you have taught this in the past, how did you do it (prior to using iPads)?
8. How comfortable do you feel using iPads with your students?
9. What resources are you using to become more comfortable?
10. In your plan for this year, you said.... How do you feel you are progressing on this plan?
11. What will you do to continue on this plan?

Appendix I: End of Year interview questions for Teachers

1. What were your goals for this year?
2. Do you think you accomplished these goals? Why or Why not?
3. How do you think your students liked using iPads in your class?
4. What are you going to do differently next year?
5. What kind of support did you receive for using iPads in your classroom this year?
6. Would you change how you find out about good iPad use next year?
7. Do you still feel the same way about using iPads in the classroom? Why or why not?

Appendix J: Student Focus Group Questions

1. How do you like using iPads?
2. What is your favorite activity?
3. Why do you think the school bought iPads to use in the classroom?
4. Do you think they help you learn? Why? Why not?
5. I know you use iPads in many different classes. How do you think (teacher) compares with the other teachers? Why do you say that?
6. What kinds of activities does (teacher) use in your class with iPads?
7. Do you like doing these activities? Why or Why not?

Appendix K: Table of Student-Centered Scaled Activities

	Teacher-Centered (1)	2	3	4	Student-Centered (5)
Student Activities (Barron & Goldman, 1994)	Memorization	Individual drills on skills	Group skills activities.	Teacher/student interaction	Student/student interaction
Student Goals (Barron & Goldman, 1994)	Discrete facts	Comprehension	Comprehension and problem solving		HOTS and Problem solving
Student Autonomy (Bray, Aoki, & Dlugosh, 2008, p. 3)(Bailey, 2006, p. 55)	Teacher directed	Teacher directed with some autonomy	Self-directed with guidance	Self-directed – independent	Self-directed – independent and assisting peers
Teacher role (Brown, 2007)	Information provider Controller	Director	Task manager	Facilitator/guide	Resource
Teacher Poses (Valli et al., 2004)	Presentation Dictation	Presentation with some LOT questions	Presentation with some interaction	Poses HOT Questions	Poses HOT problems
Teacher Responses (Richards & Rodgers, 2014)	Explicit correction	Metalinguistic correction	Repetition/Elicitation	Recast	Clarification Request Praise?
Technology Use* (Means, 1994; Murray & Olcese, 2011; Niess, 2008, 2011)	Presentation only or tutor.	skills-based technology use or as a tutor	Production based technology use used to explore and as a tool	Collaborative use/or problems solving and/or used to communicate	Collaborative problem solving and/or 21 st century skills

** No distinction was made to differentiate between those activities where iPads were used or where other technology was used*

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