A CASE STUDY EXPLORING TPACK FRAMEWORK WITHIN THE CONTEXT OF EARLY CHILDHOOD EDUCATION

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ABSTRACT

The purpose of this exploratory single-case study was to investigate the affordances of iPads and how these affordances transpired within a technological, pedagogical content knowledge (TPACK) framework by four early childhood educators at a low-income family preschool in Honolulu, Hawaii. Early childhood education (ECE) will be defined as education from birth to age eight although this study focused primarily on educators for preschool age group that is from age three to five. The targeted participants included four preschool teachers with varying technological skills and knowledge.

Methods of data collection were pre-survey, post-survey, follow-up survey, group interviews, follow-up interviews, classroom observations, and documentation of iPad workshops and other email correspondences. The data included existing data from a grant project completed at the end of 2013 and new data from follow-up interviews collected in May 2014. The data were analyzed using coding methods in two cycles.

The three major findings were 1) the exploration of affordances provided by iPads showed common themes of efficiency and effectiveness in assessing, teaching, and learning. In addition, there were some affordances particular to teaching and learning; 2) the exploration in how participating teachers discovered the affordances of iPad over time indicated parallel progression in technological knowledge and change in their value system about the affordances of iPad; and 3) the exploration in the progression of technological knowledge and change in their value system about the affordances of iPad within the TPACK framework suggested that there was a close relationship between progression of technological knowledge (TK) towards TPACK and progression of affective-valuing (AV) towards affective-characterization by value system (AC).
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CHAPTER 1. INTRODUCTION

Today the ubiquity of mobile technology is apparent across all ages. Some of the key findings by the Joan Ganz Cooney Center indicate rapid growth in young children’s exposure to and consumption of different types of digital media as well as use of mobile devices (Gutnick, Robb, Lori Takeuchi, & Kotler., 2011). Gutnick, et al. (2011) indicate that there is a drop in desktop computer ownership by 18% but an increase in laptop ownership by 31% among 60% of the families surveyed since 2005. Additional survey results indicate portability to be a popular feature in technology devices. According to Rideout (2014), the use of mobile devices such as smart phones and tablets has grown in numbers for adults as well as for children.

The affordances of these mobile devices have created opportunities for learning in some cases but also grave concern for young children’s development in other cases (DeCurtis & Ferrer, 2011; Patten & Valcarcel, 2007; Verenikina & Kervin, 2011). While there are studies to support positive outcomes for children using technology, McManis and Gunnewig (2012) explain that there are some essential components to how the integration of the technology into the learning environment should be framed. They indicate that the technology needs to be developmentally appropriate for young children, and be integrated into the classroom. Also tools need to be provided to help teachers implement technology successfully.

Statement of the Problem

There is a growing global community facing the challenge of how to integrate technology into educational settings. Although there is much research looking at this general problem, early childhood educators are faced with the additional challenge of limited research within the context of the early learning environment (Guernsey, Levine, Chiong, & Severns, 2012). Early learning environments are a unique context that is different from other age levels (Guernsey, 2014). There is a need to explore what developmentally appropriate technology integration means and how to assist teachers to
understand and implement technology integration successfully (Clements & Sarama, 2002; NAEYC & Fred Rogers Center for Early Learning and Children’s Media, 2012). One of the obstacles in assisting teachers to understand and implement technology integration successfully is lack of time for professional development (USDOE, 2010). McManis and Gunnewig (2012) recommend providing built-in support and creating effective learning communities as identified by Galinsky (2012). In recognizing these challenges, it is imperative to provide insight through research on how to assist early childhood educators to integrate technology within their pedagogical and content knowledge.

**Digital Media Technology in the Early Years**

According to a recent policy brief published by New America, “the digital age brings a profusion of new challenges and opportunities for the field of early education” (Guernsey, 2014, p. 2). Guernsey (2014) proposed the need for redesigning the digital age architecture in order to reform the system working with the birth-through-third grade continuum, thereby enhancing the benefits and facing the challenges with deeper understanding. According to Guernsey, five goals to promote this effort were to 1) set high expectations for the use of technologies when working with children of birth-through third grade, 2) boost the workforce by preparing and supporting pre- and in-service early childhood educators to appropriately integrate technology, 3) enhance current assets by distributing critical information, 4) connecting researchers, educators, and children’s media industries, and 5) encourage evaluation and research in the area of digital-age interventions and appropriate technology integration with this age group (Guernsey, 2014).

**Need for Evaluation and Research**

Although technology as a tool has been around for a long time, the recent explosion of digital media technology has exceeded all expectations (Guernsey et al., 2012; Gutnick et al., 2011). One of the surprising findings from the Joan Ganz Cooney Center report regarding educational apps in iTunes indicates that the largest number of educational apps target early learners. The rate of increase from 2009 to 2011 of these apps has been highest of any other age level as indicated in Figure 1 and 2.
Figure 1. iTunes educational apps that aim to teach target subject  
(Shuler, 2012, p. 18)

Figure 2. iTunes educational apps that target age group from 2009 to 2011  
(Shuler, 2012, p. 13)

In addition, there is a $3.5 billion future investment plan to continue this effort and yet less than half of the large number of apps targeting early learners are reviewed by credible sources such as Common Sense Media or Children’s Technology Review (Shuler, 2012). Multiple authors have pointed to a critical need to evaluate and research
in the area of digital media technology for appropriate use and integration in the educational setting (Barron et al., 2011; Gutnick et al., 2011; Rideout, 2014; Vaala, 2012).

**Need to Boost the ECE Workforce**

Guernsey (2014) emphasizes that more research and evaluation in the area of digital media technology is needed but research has no impact unless it is implemented into practice. Essential to effective implementation is ensuring that early childhood educators develop knowledge, skills, and dispositions focused on the appropriate integration of technology in the classroom (Barron et al., 2011). In their proposed technology position statement, the National Association of Education for Young Children (NAEYC) and the Fred Rogers Center for Early Learning and Children’s Media at Saint Vincent College also emphasize ongoing research and professional development needs for early childhood educators and administrators (NAEYC & Fred Rogers Center for Early Learning and Children’s Media, 2012).

**Purpose**

Following the many calls for more research on digital media technologies in the early childhood setting, the purpose of this exploratory single-case study was to investigate the affordances of iPads and how these affordances transpired within a technological pedagogical content knowledge (TPACK) framework by four early childhood educators at a low-income family preschool in Honolulu, Hawai’i. Early childhood education (ECE) is defined as education for birth to age eight although this study focused on the educators of the preschool age group that is from age three to five.

The goals of the research were to address the two specific needs mentioned above, the need for evaluation and research in the area of digital-age interventions including appropriate technology integration with this age group and the need to boost the ECE workforce by preparing and supporting pre- and in-service early childhood educators to appropriately integrate technology.

It should be noted that this study was a grant project that involved three investigators including myself. Additional follow-up interviews and recoding of data occurred after the grant project ended.
Research Questions

My research questions were:

1. What are the affordances that the iPads offered early childhood educators in assessing, teaching, and learning?
2. How did these affordances transpire within a TPACK framework for early childhood educators?

Significance of the Study

As mentioned above, there is a need to explore what developmentally appropriate integration means and how to assist teachers to understand and implement technology integration successfully (Barron et al., 2011; Clements & Sarama, 2008; Gutnick et al., 2011; NAEYC & Fred Rogers Center for Early Learning and Children’s Media, 2012). However, there are barriers for teachers such as technology resource access, teacher knowledge and confidence, and time for professional development. Some contextual barriers include uncertainty of benefits of technology in early childhood education and policies to guide administrators and teachers to appropriately integrate technology. In addition, although there were numerous studies investigating the TPACK framework, only one published study was found at the time of this study that was conducted in the context of early childhood education. This was a statistical survey study looking at early childhood educators in Taiwan (Chuang & Ho, 2011). A missing piece in TPACK research was taking an in-depth look at TPACK model within the context of early childhood education.

This study provides information for teacher educators, administrators, and leaders in early childhood education on appropriate ways to understand the TPACK framework within the context of early childhood education.

Conceptual Framework

The conceptual framework of this research is based on the technological pedagogical content knowledge (TPACK) model. This conceptual framework originated from Shulman’s pedagogical content knowledge (PCK) framework (Shulman, 1987), but
added technological knowledge thereby providing a revised framework that integrated technological pedagogical content knowledge (TPACK). Mishra and Koehler (2006) introduced this concept and soon numerous researchers started to use this concept to frame their research. The intricacies of the different knowledge components and their relationships are illustrated in Figure 3. The desired knowledge for pre- and in-service teachers to gain is at the center of this diagram where they can integrate all three knowledge areas into practice.

![Figure 3. “The TPACK framework and its knowledge components” (Koehler & Mishra, 2009, p. 63)](image)

The history and the details of this framework are provided in chapter 2 but it is important to note that this framework provided an important guide in exploring how technological knowledge integrates with pedagogical and content knowledge for early childhood educators. It is also timely to use an exploratory qualitative case study to discover the depth of the TPACK framework within the context of early childhood education since currently there is only one quantitative study within this context.

**Summary of Methodology**

This study was conducted using a qualitative rather than quantitative approach. The methodology or strategy used was an exploratory single-case study. Case study is an appropriate methodology for a study that attempts to answer “how” and “why” research questions in order to explain real-life circumstance or social phenomenon.
(Creswell, 2003; Patton, 2005; Yin, 2014). The case study also takes on a constructivist paradigm (Stake, 1995; Yin, 2003). Yin (2014) and Stake (1995) further explain that this method is appropriate for research questions that seek “in-depth” description of some social phenomenon.

Among the three different types of case study described by Yin (Yin, 2014), the exploratory single-case study is most appropriate for this research due to the “exploratory” nature of the study in answering how the integration of technology occurs for early childhood educators given the lack of earlier studies on the topic and the unknown outcomes. As recommended, every exploration should have a “purpose” and the criteria on how the exploration will be examined (Yin, 2014), providing rigor to the study.

For this case study, participants were selected using purposive sampling. The early childhood education context was important to this study and the four preschool teachers were carefully selected using two criteria. First, the preschool teachers needed to have some teaching experience and second, they had to be willing to learn and explore affordances of the iPad.

Instrumentation or sources of evidence (Yin, 2014) included surveys, interviews, observations, and documentation. The three types of surveys were pre-survey, post-survey, and a follow-up survey that included five follow-up questions. The main interview was a group interview with additional follow-up interviews with the preschool teachers conducted in May 2014. Extensive observations were conducted in each teacher’s classroom and documentations included transcription of the three iPad workshops, field notes, and email correspondences with the participants.

Due to the fact that this study was part of a grant project that ended in 2013, data collection consisted of both existing and new data. Existing data included surveys, interviews, observations, and documentations as described above. The new data were the follow-up interviews with the participants after the grant ended to further explore the impacts and themes identified. The detailed timeline of when these data were collected and brief description of the purpose for collecting these data are in Table 1.
Table 1. Data Collection Timeline and Purpose

<table>
<thead>
<tr>
<th>Time</th>
<th>Instrument</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2013</td>
<td>Pre-survey</td>
<td>To establish baseline for teachers’ technological knowledge (TK)</td>
</tr>
<tr>
<td>February 2013</td>
<td>Documentation</td>
<td>To document iPad Workshop 1 for teachers</td>
</tr>
<tr>
<td>March 2013</td>
<td>Documentation</td>
<td>To document iPad Workshop 2 for teachers</td>
</tr>
<tr>
<td>April 2013</td>
<td>Observations</td>
<td>To observe how teachers use iPad in the classroom</td>
</tr>
<tr>
<td>May 2013</td>
<td>Documentation</td>
<td>To document iPad Workshop 3 for teachers</td>
</tr>
<tr>
<td></td>
<td>Group interview</td>
<td>To identify various affordances of iPads through semi-structured group interview</td>
</tr>
<tr>
<td>June 2013</td>
<td>Post-survey</td>
<td>To establish change in teachers’ technological knowledge (TK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK)</td>
</tr>
<tr>
<td>August 2013</td>
<td>Follow-up survey</td>
<td>To discover what, how, and why teachers’ technological knowledge changed</td>
</tr>
<tr>
<td>May 2014</td>
<td>Follow-up interviews</td>
<td>To gain more in-depth knowledge regarding change in their technological pedagogical and content knowledge (TPACK)</td>
</tr>
</tbody>
</table>

The data analysis used a two-stage coding method. Saldaña (2009) described these two stages as “cycles of coding.” The first cycle of coding included initial, holistic and provisional methods conducted in three different stages. The first stage of the first cycle of coding used initial coding to establish the characteristics of the participants related to technological knowledge. Characteristics provided establishment of different levels of technological knowledge and changes that occurred over time in relation to their technological knowledge. The second stage of the first cycle of coding used holistic coding to provide insights on the various affordances of the iPads and provisional coding to help formulate follow-up interview questions. The third stage of the first cycle of coding occurred after conducting the follow-up interviews. Provisional coding was used to establish a predetermined list of codes that relate to the TPACK framework and affective domain taxonomy. The second cycle of coding included provisional and values coding that provided in-depth analysis of the data (Saldaña, 2009). More detailed information regarding the methodology is provided in Chapter 3.
Role of the Researcher

I am currently an early childhood education director at a private university in Honolulu, Hawai‘i. As a director, I am responsible for overseeing undergraduate and graduate programs in early childhood and Montessori teacher education, but I also spend a significant amount of time working with the early childhood education community in the state of Hawai‘i. As a director of the program, I built relationships with many of our current and former students. As a community partner, I also built relationships with many preschool directors for various projects and collaborations. In this particular study, one of the participants was a former student from our graduate program.

My role as the primary researcher of this study was both emic and etic (Headland, 2004; Morris, Leung, Ames, & Lickel, 1999); the emic role due to the context of early childhood education field and the etic role since I am not part of the preschool to which the participants belong. There was an advantage to being an insider within the early childhood education context of this study. This common ground provided an instant connection with the participants. We spoke the same language within the profession and we found comfort in the fact that we had a mutual understanding of the challenges and triumphs of being an early childhood educator. On the other hand, being an outsider to the organization to which all the participants belonged created a safer environment for the participants to share openly and honestly.

As a grant project involving two additional investigators, there was a balance to my role as I approached the study using the “human instrument” (Guba & Lincoln, 1981, p. 113) with “theoretical sensitivity” (Strauss & Corbin, 1990, p. 42). Theoretical sensitivity is a quality of a researcher that brings insight, meaning to data, and the ability to recognize pertinent information (Strauss & Corbin, 1990). This comes from a number of sources, including professional literature, professional experiences, and personal experiences. The credibility of a qualitative research report relies heavily on the confidence readers have in the researcher's ability to be sensitive to the data and to make appropriate decisions in the field (Eisner, 1991; Patton, 2002).

As with any other study but more so with a case study, I had to be cognizant of my own biases, assumptions, and expectations since these can hinder the “lenses” used in the
interpretation of the data. Yin (Yin, 2014) suggests the good skills and values of the researcher as starters, with the addition of, “training” in case study methodology and developing a “protocol” for the study (p. 71). I also practiced an “empathic neutrality” (Patton, 2002, p. 50) to keep a balance between my emic and etic roles. One of the essential components to this study was the context. Thus, I tried to keep “context sensitivity” (Nunes, Martins, Zhou, Alajamy, & Al-mamari, 2010, p. 1) which brought sensitivity to the context of the research and “theoretical sensitivity” (Strauss & Corbin, 1990, p. 42).

**Limitations**

All research designs have potential strengths and limitations (Creswell, 2003; Patton, 2002). Quantitative researchers have often criticized the limitations of a qualitative paradigm. One such area is the generalizability of a case study. However, Yin (Yin, 2014) explains that a case study can provide “analytic generalization” which is different from “statistical generalization” often used in an empirical study (p. 40). This study was limited to four participants but the goal was analytic generalization where findings will provide some contribution to a theoretical concept or principle.

Another limitation often involves the potential subjective nature of a case study. One of the reasons for this can be attributed to the roles of a researcher in qualitative and quantitative study. For example, in a quantitative approach, the researcher stays neutral during data collection and analysis, but in qualitative study, the researcher is considered the "human instrument" (Denzin & Lincoln, 2008). This means that the researcher is the primary instrument of the data collection and that analysis is subject to the researcher’s training in observation and interviewing. In this study, I have been conscious of my own biases and have tried to focus on credibility, consistency, and transferability in order to alleviate this limitation (Merriam, 2009). Although biases cannot be avoided completely, I minimize them by providing multiple sources of evidence to triangulate the data collected (Denzin & Lincoln, 2008).
Definition of Key Terms

Affordances. The original definition described all actions that are physically possible. In this study, it is used in the context of human–computer interaction (HCI) to indicate the discoverability of possible actions or usage of objects such as iPad.

DAP. Developmentally appropriate practice (DAP) is an approach to teaching grounded in the research on how young children develop and learn and in the context of effective early education. Its framework is designed to promote young children's optimal learning and development.

Early Childhood Educator. This is any professional working in the Early Childhood Education field, including but not limited to center-based and family child care providers, infant and toddler specialists, early intervention specialists and early childhood special educators, home visitors, related service providers, administrators, Head Start teachers, Early Head Start teachers, preschool and other teachers, teacher assistants, family service staff, and health coordinators.

ECE. Early childhood education (ECE) is a branch of educational theory that relates to the teaching of young children up until the age of about eight, with a particular focus on education, notably in the period before the start of compulsory education.

TPACK. Technological pedagogical content knowledge (TPACK) is a framework to understand and describe the kinds of knowledge needed by a teacher for effective pedagogical practice in a technology enhanced learning environment.

Summary

The affordances of technology in education have brought much attention to how we train and support our pre- and in-service teachers. Although there have been many studies investigating how the technological pedagogical content knowledge framework can provide ways to move towards quality 21st century teachers in the context of elementary and secondary teachers, in-depth examinations of this framework within an early childhood education context are extremely limited.

According to recent policy brief (Guernsey, 2014), there is a national need to redesign the digital age architecture to reform the system working with birth-through-
third grade continuum, thereby enhancing the benefits and facing the challenges with deeper understanding. However, there is both a gap in the early childhood workforce involving their technological knowledge and a lack of research in this area.

This study attempted to provide some insights into filling this gap through an in-depth look at how TPACK model can work within the context of early childhood education.

The following chapters provide various aspects of this study. Chapter 2 provides a literature review of this topic. Chapter 3 provides detailed information regarding the methodology including data collection and analysis of the data. Chapter 4 provides the findings. Chapter 5 discusses the findings, implications of the findings, and recommendations for future research.
CHAPTER 2. REVIEW OF LITERATURE

As indicated in Chapter 1, integrating technology in early childhood education is a controversial topic. To understand the context for this study, this chapter covers background information regarding early childhood education, the affective domain for learning, developmentally appropriate practice as a pedagogical approach for early childhood education, and technology in the education of young children. The chapter also describes the related research studies on the technological pedagogical content knowledge (TPACK) framework and provides theoretical perspectives advanced over time.

Early Childhood Education

In order to understand the context of this study, this section provides a brief history of early childhood education, the rise of professional development for early childhood educators, and the characteristics of early childhood educators. The definition being used for this study is from the National Association of Early Childhood Teacher Educators’ (NAECTE) glossary of terms that defines Early Childhood as the period between birth and eight years of age, a definition based on documented intellectual and emotional development milestones. This definition is grounded in an extensive body of research documenting that young children’s ways of knowing differ considerably from those of older children and adults.

History of Early Childhood Education

Early childhood education experienced an evolution as new thoughts developed about child development over time. The focus here is a few pivotal events and contributors in the history of child development.

Child development views are shaped by religious, political, and economic beliefs of the time as well as cultural influences (Gordon, Browne, & Gordon, 2007). Theorists, philosophers, and educators such as John Amos Comenius, Maria Montessori, Jean Piaget, John Locke, Jean-Jacques Rousseau, Erik Erikson, and Lev Vygotsky all had
tremendous influence on how early childhood education and child development are understood today.

However, the foundation of “caring” as an essential component of “educating” the child was introduced by Johann Heinrich Pestalozzi (1746-1827) who emphasized an integrated curriculum to foster the whole child (Gordon et al., 2007). Later, Erik Erikson (1902-1994) developed his psychosocial (stage) theory as an extension of Freud’s psychoanalytic theory. Erikson extended his theory to include eight stages across one’s lifespan (Berk, 2008). According to Erikson, the environment in which a child lives is crucial to providing growth, adjustment, and is a source of self-awareness and identity. Other theorists such as John Bowlby (1907-1990) and Mary Ainsworth (1913-1999) further studied the theory of attachment. The significance of this theory is that healthy attachment experience in the early years can lead to number of outcomes including stronger self-esteem and better self-reliance (Bretherton, 1992).

Edward Tronick and his colleagues presented additional contributions to the theory of social/emotional child development. The famous “still-face” experiment indicated that the nature of the relationship between infants and adults plays a critical factor in the social and emotional development of infants (Tronick, E. Z. & Cohn, 1989). Their research showed that infants display a variety of specific affective expressions appropriate to the specific contexts in which these expressions occurred. Infants also demonstrated that they have an appropriate understanding of the emotional meaning of the affective displays of their caregivers.

Gordon and Browne (2007) indicated that the “call for a universal education and literacy” (p. 6) began with Martin Luther in the sixteenth century. The term “kindergarten,” which was translated from German word for “children’s garden,” originated with Friedrich Froebel. As the “father of kindergarten,” he was first to emphasize “play” as a way to learn and “garden” as their learning environment. During this time, the dominant human and child development theory held by behaviorists was that behavior was a result of hereditary influences having nothing to do with actual experiences. However, theorists such as Lev Vygotsky, Erik Erikson, Maria Montessori, and Jean Piaget presented different perspectives in looking at development of a child. In the United States, John Dewey influenced the direction of education by introducing it as
part of a “progressive movement” that emphasized learning should be meaningful experiences guided by knowledgeable teachers which changed the tone of teachers’ roles (Crump, 2010, p. 23). According to Roopnarine and Johnson (1993), this was the start of ‘developmentally appropriate practice’ as teachers’ roles changed and need for trained teachers expanded (as cited by Crump, 2010). Dewey also insisted on the importance of inquiry-based learning and integrated curriculum.

Crump (2010) reported that early childhood educators were often not perceived as professionals. Historically, this was due to the fact that early childhood educators required no formal education and most people believed that early childhood educators did not require any skills or special knowledge, but only needed to like children (Gordon & Browne, 2008). This general perception from the early sixteenth century still continues today. Rust (1993) explained that the early childhood education field was ‘women’s work’ that continued to be of low status and low pay (as cited in Crump, 2010, p. 29). In addition, the lack of common standards within the profession contributed to this perception among the general public and other professionals.

Some of these perceptions gradually changed as the leaders in the early childhood education field started to form organizations and common standards that they all shared. National Association of Education for Young Children (NAEYC) was established in early 1980’s and led the early childhood education (ECE) field to the next level that it needed to be as a profession. In 2012, the NAEYC had over 4,000 members and established standards and position statements for various topics in ECE. They provided standards that were expected for young children aged birth to eight, and developed standards for ECE professionals preparing to become early childhood educators.

**Early Childhood Educators’ Professional Development**

As mentioned above, early childhood educators were not perceived as professionals and traditionally had low educational and employment requirements (Spodek & Saracho, 2006). This perception, however, is changing as numerous studies have shown that higher quality care can have beneficial effects (Schweinhart et al., 2005).
and better quality care correlates with the quality education of caregivers (Burchinal, Cryer, Clifford, & Howes, 2002).

Within the last decade, there has been a tremendous attention to early childhood education. Currently, the legislative report conducted through Pre-K Now indicates that state funding for pre-K in the U.S. more than doubled nationwide to $5.4 billion from fiscal year 2002 to fiscal year 2010. In addition, pre-kindergarten access increased from 700,000 children in 2001 to 1.3 million children in 2012 (Pre-K Now, 2012). Many states are recognizing the importance of early childhood education and are supportive of quality early childhood education (Schweinhart, 2008; Wortham, 2006). One of the most important factors to ensure the quality of the early childhood education involves nurturing the quality education of early childhood teachers. Due to the various initiatives and incentives, many preschool teachers are going back to higher educational institutes to obtain higher degrees or gain knowledge through professional development.

**Early Childhood Educators’ Characteristics**

Early childhood educators have distinctive attributes from elementary or secondary level educators. A study conducted by Saluja, Early, and Clifford (2002) reports that approximately 284,277 teachers of three- and four-year-old students are working in the United States. Ninety-nine percent of that total number are females, with an average age of 39. This study also estimates that 78% are White, 10% are African American, and 6% are Hispanic. Less than 1% are American Indian or Native Alaskan and only 1% are Asian or Pacific Islander. The remaining 4% are classified as mixed or other. In terms of educational attainment, 19% earned a child development associate (CDA), 12% have the associate’s degree, 31% have the bachelor’s degree, and 13% have earned degrees beyond bachelor’s level.

According to a study done by Phillips and Hatch (1999), there were several intrinsic motivations that brought early childhood educators into the field. Many chose to teach simply because they truly love children. They were also caring and affectionate which implies that early childhood educators must enjoy interacting with other people and are affective in nature. This same group enjoyed challenges and responsibilities that lead them to be very resourceful. The subjects of this study considered early childhood
education a most challenging and rewarding profession and had a desire for life-long learning. They had a strong sense of community with a desire to make a difference in the lives of young children. They wanted to contribute to the society and worked collaboratively with each other (Phillips & Hatch, 1999). Historically this field attracted educators who promoted and desired a positive affective learning environment (Saluja et al., 2002).

**Affective Domain**

The affective domain is not only important within the ECE profession but also important for early childhood educators as learners. This section will provide some background information about the affective domain for learning.

**Affective Domain for Learning**

Given the history and characteristics of educators in early childhood education, the affective domain plays a critical role for student success and engagement (Saluja et al., 2002). However, designing for the affective domain is not an easy task given that there are many definitions of the affective domain for learning (Hoffman, 2009; Main, 1992). Many researchers point out the importance of the affective domain to achieve better learning outcomes (Kretchmar, 2014; Pierre & Oughton, 2007; Shephard, 2008), yet there is a lack of systematic ways to measure and understand this domain. One reason for this is the absence of a universal definition as Martin and Briggs (1986) indicated in their study. The various definitions covered by researchers range from attitudes and values to motivation and interests. Main (1992) investigated an instructional design inclusive of affective domain but indicates that it needed further improvements in order to be operationalized.

To understand the affective domain for learning, many researchers have attempted to classify it by types and levels. Holt and Hannon (2006) implied that the affective domain was the most-overlooked of the three domains identified by the Bloom and Krathwohl's taxonomies that included cognitive, psychomotor, and affective domains.
However, Pierre and Oughton (2007) claimed that the affective domain was the gateway to learning, despite cognitive and psychomotor domains taking precedence.

**Affective Domain Taxonomy**

The affective domain for learning taxonomy was further developed by Krathwohl (2002) as a system for specifying attitudinal objectives. Similar to Bloom’s cognitive taxonomy, Krathwohl attempted to organize the objectives of affective domains for learning in a hierarchical order. However, measuring affective objectives were far more difficult than evaluating cognitive educational objective levels. According to Krathwohl (2002), affective learning was demonstrated by behaviors indicating attitudes of awareness, interest, attention, concern, responsibility, the ability to listen and respond in interactions with others, and the ability to demonstrate these attitudinal characteristics or values. However, Owen-Smith (2008) explained that unfortunately in higher education, there was a defining ‘split’ between the affective and the cognitive where affective discourse translated to pedagogy that lacks rigor.

Many researchers argued that there were clear overlaps between subcategories of the cognitive and affective domains (Krathwohl, Bloom, & Masia, 1964). Rokeach (1960) stated that every cognitive behavior had its affective counterpart. More recent studies showed varying degrees of influence between affective and cognitive. Harmon-Jones, Gable, and Price (2012) concluded “how emotion can impair and improve certain cognitive processes” and the relationship could be bi-directional between the affective and cognitive (p. 1). Rather than seeking to resolve this debate over cognitive vs. affective primacy in favor of one hypothesis or the other, a more productive goal may be to determine the factors that cause affective information to have processing priority in some circumstances and ontological information in others. This study supported “a view of the mind according to which words and pictures activate different neurocognitive representations every time they were processed, the specifics of which were co-determined by the stimuli and the contexts in which they occur.” (Lai, Hagoort, & Casasanto, 2012, p. 8).

Regardless of the debate over affective and cognitive primacy, researchers at Center for Applied Special Technology (CAST) reported that affect was one of the
critical elements to learning and those learners could differ in the way they engage and their motivation to learn. There are multiple factors that can influence this including but not limited to neurology, culture, personal relevance, subjectivity, and background knowledge, along with a variety of other factors. (CAST, 2011).

Content and Pedagogy in Early Childhood Education

As much as the affective domain influenced early childhood educators, content and pedagogy in early childhood education played an equally important role in the field over time. The content and pedagogy of early childhood education transformed as child development concepts changed throughout history. Shifting from the notion that a child started as a blank slate to the child scaffolding their own knowledge brought huge changes in the way teachers educated young children. In addition, numerous philosophers and theorists in child development influenced trends in content and pedagogical approach. Among those were John Dewey’s progressive movement, Jean Piaget’s cognitive development theory, Lev Vygotsky’s social constructivist approach, Maria Montessori’s pedagogy, play-based approach, Reggio Emilia’s approach, and Robert Steinbeck’s Waldorf approach to name a few.

The knowledge base for pre-service early childhood teacher education typically was thought to be inextricably linked with the concepts of child development, pedagogy, and assessment (Allen, 2008). Though NAEYC’s standards were accepted within the field of early education and care and endorsed by National Council for Accreditation of Teacher Education (NCATE), they were not universally incorporated into teacher preparation programs across the country. There were no uniform systems of preschool teacher preparation programs in the United States that were comparable to the structure of elementary and secondary teacher preparation programs (O’Brien, 2012). However, early childhood educators have come to accept the notion of developmentally appropriate practice (DAP) as one of the universal approaches to early childhood education.

Developmentally Appropriate Practice (DAP)

NAEYC defined DAP as an approach to teaching grounded in research on how young children develop and learn. Its framework was designed to promote young
children’s optimal learning in light of their given stage of development, addressing children as individuals and as part of a group, helping each child meet challenging and achievable learning goals.

DAP Development and Teacher’s Role

DAP provided the foundation for all of NAEYC's work when the first definitive position was adopted by NAEYC in 1987. With the development of an accreditation system by NAEYC, a more detailed and specific working definition was necessary. With various other organizations such as Association for Childhood Education International (ACEI), National Association of Elementary School Principals (NAESP), and National Association of State Boards of Education (NASBE), NAEYC continued to update the definitions of DAP. Bredekamp and Rosegrant eventually updated the “Guidelines for Appropriate Curriculum Content and Assessment in Programs Serving Children Ages 3 Through 8,” Volume 1 (1992) and Volume 2 (1995) jointly with the National Association of Early Childhood Specialists and State Departments of Education (NAECS/SDE).

The most recent position statement was published in November 2008 (Copple & Bredekamp, 2009) and many early childhood professionals, parents, and communities have been grateful for the guidelines as they encounter ever-changing research and direction in this field.

The three core knowledge considerations for early childhood education include the following (www.naeyc.org):

1. Knowledge about typical development at different age and developmental stages that are based on research. This guides the teachers in what is the most appropriate experience for the children’s learning and development.
2. Knowledge about each individual child through continuous observations. These observations guide the teachers to understand each child as an individual including their abilities and interests.
3. Knowledge about the children’s families which guides the teachers to provide meaningful, relevant, and respectful learning.

There have been numerous debates over DAP since the first position statement (Charlesworth, 1998a, 1998b; Lubeck, 1998a, 1998b), but over the years the leaders in
the field agreed to the 12 principles of child development and learning as a guideline. More importantly, five key aspects of the teacher’s role have been emphasized that include: 1) creating a caring community of learners, 2) teaching to enhance development and learning, 3) planning curriculum to achieve important goals, 4) assessing children's development and learning, and 5) establishing reciprocal relationships with families. Each of these aspects has been affected by the technological milieu within which the teacher’s role is practiced.

**Technology in Early Childhood Education**

The ubiquity of mobile technology today, even for young children have certainly raised questions regarding how mobile technology fits into developmentally appropriate practice. Some of the key findings by the Joan Ganz Cooney Center indicated rapid growth in children’s exposure to and consumption of different types of digital media as well as mobile device use (Gutnick et al., 2011). Gutnick, et al. (2011) indicated there was a drop in desktop ownership by 18% but an increase in laptop ownership by 31% among 60% of the families of young children surveyed since 2005. Additional survey results indicated portability to be a popular feature in technology devices. According to Rideout (2011), the use of mobile devices such as smart phones and tablets has risen not only among adults but also among young children.

The affordance of these mobile devices have become opportunities for learning in some cases but also cause for grave concern for young children’s development in other cases (DeCurtis & Ferrer, 2011; Patten & Valcarcel, 2007; Verenikina & Kervin, 2011). While there are studies that support positive outcomes for children using technology, McManis and Gunnewig (2012) argued that there are some essential components as to how the integration of the technology should be framed. They assert that the technology needs to be developmentally appropriate for children and that tools need to be provided to help teachers successfully integrate technology into the classroom and curriculum.

As a growing community both at national and state level faced this challenge, there was a need to explore the meaning of developmentally appropriate integration and how to assist teachers to understand and implement technology integration successfully
(Clements & Sarama, 2002; NAEYC & Fred Rogers Center for Early Learning and Children’s Media, 2012). One of the obstacles in assisting teachers to understand and implement technology integration was the lack of time for professional development (USDOE, 2010). McManis and Gunnewig (2012) suggested providing built-in supports and creating effective learning communities among teachers was identified by Galinsky (2012). Additionally, Bittman, Rutherford, Brown, and Unsworth (2011) reported the importance of the parental context in framing media use for young children. This was not surprising since in early childhood education, it is imperative to engage families and parents in the development of their children. Numerous studies have shown that family engagement leads to positive outcomes for children (Mendez, 2010; Powell, Son, File, & Juan, 2010).

**Current Trends and Issues**

A common complaint among parents is that children spend too much time in front of screens of various sorts – computers, television, handheld devices, and gaming systems. In fact, a study on children’s computer use indicated that children can have musculoskeletal injuries, vision problems, and obesity due to extended use of these technologies (Cordes & Miller, 2000).

As an educational tool, however, there is much to learn about how computer or computer-like technology can foster the development of children in early educational settings. Recent developments with new computer technology have changed basic accessibility, portability, and usefulness of computers as powerful learning tools. Noting the national debate about young children using digital technologies, Verenikina and Kervin (2011) found that although iPads can serve as a vehicle to facilitate positive early education environments, children often preferred games that allowed them to engage their imagination and develop their own play beyond the screen itself and into other contexts. DeCurtis and Ferrer (2011) discussed how the use of tablets or the iPad fit well within Piaget’s first two stages of cognitive development, the sensorimotor stage (birth to age 2) and preoperational stage (ages 2 to 7). Tablets, especially applications or apps on a device like the iPad, helped children learn, through their senses, gross and fine motor skills. They learn to use symbols for objects, and to think beyond the immediate present.
The iPad’s ubiquity has resulted in extensive discussions in the newspapers and public media of this new device as a tool for learning in multiple school settings (Baute, 2010; Malone, 2011). Current research includes experiments ranging from algebra textbook replacement with iPads (Takahashi, 2011) to discussions about preparing students for the future lives through mobile technology (Bestwick & Campbell, 2010). Public schools experimenting with iPad or tablet technology also offered affordances such as helping special needs students develop self-directed, personalized learning and facilitating English language learner students (Patten & Valcarcel, 2007).

Yet primary research on the tablet technology’s effectiveness in early childhood education remains scant. Researchers have called for more extensive research on the use of tablet technology for young children to answer some critical research questions, including how do children learn best and how to integrate technology appropriately into preschool settings (DeCurtis & Ferrer, 2011; Verenikina & Kervin, 2011). At the level of early childhood education, some preliminary research work has been conducted. Vincent (2007) noted that use of technology (in this case, a SMART board) can enhance teaching young children when the teacher had the skills and knowledge to effectively use the technology with children. For example, Bell and Trundle (2008) showed that appropriate integration of the technology into instruction resulted in high levels of understanding the phases of the moon in a preschool setting.

**Early Childhood Educators and Technology**

Although some people have accepted technology as a positive influence when it comes to application with special needs children, the obstacles to the use of technology use in the classroom by early childhood educators include lack of training, funding, interest, and trust that there will be legislative impact (Hutinger et al., 1994).

When teachers were able to integrate technology into the classroom and used it appropriately, Haugland (2000) argued that computers could be valuable tools. In some cases, there was increased social interaction and help for a child to learn in new ways (Buckleitner, 2010; Haugland, 2000). Clements and Sarama (2002) claimed that appropriate use of the educational software can help develop critical thinking, problem solving, creativity, and mathematical thinking skills and moreover, the software can be
adjustable to individual’s needs. Other technologies such as digital cameras, videos, scanners, and the Internet were used within a social context and proved to have productive results (Bell, 2004; Hutinger et al., 1994; Latchem & Robinson, 2003).

Lack of training remained a major issue along with lack of time when it came to implementing technology to its full extent (Beach & Stefanick, 2010; Kelley, Wetzel, Padgett, Kim, & Odom, 2003). Secondary to lack of training, teachers’ comfort levels and knowledge of technology limited the success of technology integration into classrooms (Wardle, 2000). Rivera, Galarza, Entz, and Tharp (2002) reported that early childhood teachers who completed workshops and increased knowledge and skills resulted in positive outcomes using technology with the children in the classroom.

**Technological Pedagogical Content Knowledge (TPACK)**

As aforementioned, the quality of early childhood education is largely dependent on the quality of the teachers. At the same time, technology is playing a larger role in the lives of young children. It is no longer a debate over if young children should have access to technology as it is already in the hands of many young children (Gutnick et al., 2011; Wartella, Rideout, Lauricella, & Connell, 2013). Cuban (2001) indicated that the role of technology is not always understood or utilized to its full potential and thus has not always achieved its intended purposes and visions. This is especially true in the case of early childhood education which leads to the importance of how to prepare teachers to advance in their knowledge of the use of technology in teaching and learning, realizing its full potential to enhance learning outcomes (Roschelle, Pea, Hoadley, Gordin, & Means, 2000; Sefton-Green, 2006). Technological, pedagogical, and content knowledge (TPACK) is one model that can assist teachers’ understanding of the complex connection between technology, pedagogy, and content for effective teaching.

**TPACK Development**

The concept of connecting different knowledge domains for teaching originated with Shulman (1986) who proposed that teachers needed to blend pedagogical and content knowledge (PCK) in order to teach effectively. Mishra and Koehler (2006)
expanded this concept of PCK by adding technological knowledge into the formula to create the TPACK framework.

TPACK is a framework where the relationships between a teacher’s knowledge of content (CK), pedagogy (PK), and technology (TK) are well orchestrated to bring about effective teaching. Mishra and Koehler (2006) and Koehler and Mishra (2009) further added the combination and intersections of these components as technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technological content knowledge (TCK). The following table provides definitions of the seven components of TPACK by Chuang and Ho (2011).

Table 2. Components of TPACK

(Chuang & Ho, 2011, p. 101-102)

<table>
<thead>
<tr>
<th>Components</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology knowledge (TK)</td>
<td>Knowledge about various technologies, ranging from low-tech traditional technologies, such as pencil and paper, blackboard to digital technologies, such as the Internet, digital video, interactive whiteboards, computer-mediated communication software programs.</td>
</tr>
<tr>
<td>Content knowledge (CK)</td>
<td>Knowledge about the actual subject matters and specific content domains such as math and science that teachers must know about and familiar with in order to teach.</td>
</tr>
<tr>
<td>Pedagogical knowledge (PK)</td>
<td>Knowledge about the processes and practices of teaching and learning such as classroom management, lesson plan development, and student evaluation to achieve overall educational purposes, values, and goals.</td>
</tr>
<tr>
<td>Pedagogical content knowledge (PCK)</td>
<td>Knowledge that deals with the teaching process and the transformation of subject matter into teaching (Shulman, 1986). Pedagogical content knowledge is different for various content areas, as it blends both content and pedagogy with the goal to develop better teaching practices in each of various content areas.</td>
</tr>
</tbody>
</table>
Technological content knowledge (TCK) Knowledge of how technology can create new representations for specific contents and can impact the practices and knowledge of a given discipline. It suggests that teachers understand that, by utilizing a specific technology in teaching and learning, they can change the way learners practice and comprehend concepts in a specific content area.

Technological pedagogical knowledge (TPK) Knowledge of how various technologies can be used in teaching and understanding that using technology may change the way teachers teach. This includes the knowledge of pedagogical affordances and constraints of different technological tools.

Technological pedagogical content knowledge (TPACK) Knowledge of the complex interplay and interaction among the three basic components of knowledge (CK, PK, TK) that a teacher possesses when teaching content using appropriate pedagogical methods and technologies. It is the basis of effective teaching with technology.

Koehler, Shin, & Mishra (2014) reviewed over 300 TPACK related articles but no defining developmental sequence has been found because of the unique challenges in developing TPACK. For pre-service teacher candidates typically have minimal TPACK constructs but in-service professional development participants already have certain level of TPACK constructs. This, of course, can vary depending on the experience level and comfort level of their teaching and technology use. Koehler, Shin, & Mishra (2014) further explained that there are several approaches in implementing TPACK especially for the in-service professional development.

In the PCK to TPACK approach, technology is introduced to support and enhance the pedagogical and content knowledge used in the classroom. This approach seems to make sense but experienced teachers also bring preconceptions that are difficult to change or they may not be willing to try something new (Niess, van Zee, & Gillow-Wiles, 2010). Angeli and Valanides (2009) found significant improvements in students’ performance on design tasks towards the end of the semester when the pre-service
teachers already had basic TPK but had not yet taken content-specific methods courses. In addition, trying to develop PCK simultaneously with TPACK forced the teacher training program to look into a systematic integration of technology but this posed some cognitive load challenges (Koehler et al., 2014).

Koehler, Mishra, Kereluik, Shin, & Graham (2014) indicate that numerous instruments were developed to assess pre- and in-service teachers within the TPACK framework but only 66 research publications met the inclusion criteria among 303 TPACK related articles. From those research articles, 141 instruments of various types were found. A summary of those instruments are listed in the table below.

**Table 3. Research on Measuring TPACK**

(Koehler, et al., 2014, p. 104-105)

<table>
<thead>
<tr>
<th>Instrument Types</th>
<th>Participants</th>
<th>Number of Research</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-report</td>
<td>Mostly pre- or in-service teachers</td>
<td>31</td>
<td>Numerically rate their agreement with statements regarding technology and teaching</td>
</tr>
<tr>
<td>Open-ended questionnaires</td>
<td>All pre- or in-service teachers</td>
<td>20</td>
<td>Provide overall experience in an educational technology course or professional development program that are designed to promote pre- or in-service teachers’ TPACK</td>
</tr>
<tr>
<td>Performance assessments</td>
<td>All pre- or in-service teachers</td>
<td>31</td>
<td>Examine participants’ performance on tasks that are designed to represent authentic teaching tasks or scenarios</td>
</tr>
<tr>
<td>Interviews</td>
<td>Mostly pre- or in-service teachers</td>
<td>30</td>
<td>Typically include a pre-determined set of questions and interviews are recorded for later transcription, analysis, and coding</td>
</tr>
<tr>
<td>Observations</td>
<td>Mostly pre- or in-service</td>
<td>29</td>
<td>Observe participants’ TPACK at a given time point and to track the</td>
</tr>
</tbody>
</table>
teachers development of their TPACK over time. Observations were typically conducted either in classrooms or during a professional development session.

TPACK for Early Childhood Educators

There were several studies that addressed content specific areas using TPACK (Graham et al., 2009; Hammond & Manfra, 2009; Niess, 2005) but to date, there is only one research study that addressed early childhood teachers. Chuang and Ho (2011) investigated TPACK for early childhood teachers in Taiwan. They used a sample of 335 in-service teachers using a TPACK survey adapted from Schmidt et al. (2009). Early childhood teachers who were older had higher self-assessed PK and PCK than the younger teachers but younger teachers had higher self-assessed TK. Regardless of age, teachers who spent 20 hours or more using technology a week had higher TK and TCK than those who spend less than five hours a week.

This study by Chuang and Ho (2011) also provided examples of various instruments developed to measure TPACK in elementary and secondary schools but there was a void in research pertaining to TPACK in the early childhood education settings. Chuang and Ho (2011) further indicated that globally technology was commonly integrated into the early childhood classroom (OECD, 2006). In Taiwan, for example, there are more private preschools and those schools tend to have abundant resources. Thus, this study concluded that early childhood teachers must develop TPACK to be effective teachers of today.

Summary

The unique characteristics for teachers of young children bring new perspectives to how TPACK might apply, especially in the context of pedagogical knowledge. This chapter looked at specific issues found in early childhood educators as learners through
descriptive case studies and found that the affective domain for learning was a major factor for successful efforts in teaching and learning for this population.

In addition, developmentally appropriate integration of technology in the early learning environment appears to be a controversial issue yet currently there is a lack of in-depth research on this topic. In the next chapter, these variables contribute to the research design and methodology for this study.
CHAPTER 3. METHODOLOGY

The purpose of this exploratory case study is to investigate the use of iPads by four early childhood educators and how that affected technology integration within a technological pedagogical content knowledge (TPACK) framework at a low-income family preschool in Honolulu, Hawai’i.

This chapter examines the research design pertaining to this qualitative exploratory single-case study and the conceptual framework used to shape this research design. In addition, this chapter includes detailed information about participants and their setting, the role of the researcher, instrumentations and procedures, data collection, data analysis, validity, and introduction to product and theme development.

Research Design

The research approach of this study was within the qualitative paradigm where knowledge claims were based primarily on constructivist perspectives using case study methodology (Creswell, 2003). The rationale for selecting the case study approach was twofold. First, case study is an ideal methodology for in-depth investigation (Creswell, 2003; Feagin, Orum, & Sjoberg, 1991; Yin, 2014). Second, this study covered a real-life situation that had the potential to answer how and why questions by exploring process and relationships (Yin, 2014).

The Case Study Methodology

Yin (2012) identifies three steps to designing a case study. The first step is to determine if this is a single or multiple case study. This study is a single-case design because the focus was not on individual teachers but four teachers as a collective of early childhood educators with varying technological knowledge. The second step to designing a case study is to determine the type by choosing holistic or embedded case study. The four different case designs are illustrated by Yin (2012) in Figure 4.
In this single-case study, the unit of analysis is holistic so it is a holistic single-case design. The third step indicated by Yin (2012) is identifying the theory used in the case study. This exploratory holistic single-case study explores the TPACK framework to investigate how early childhood educators gain technological knowledge and how technological knowledge blends into pedagogical and content knowledge.

The Components of Case Study Design

Yin (Yin, 2014) describes five important components to a case study. The first component is the study questions. The study questions in case study, unlike other types of qualitative approach, attempt to answer how and why questions. The emphasis is on the relationships and the process. The second component is the study proposition. In this case, the proposition directs the importance of the affective domain for learning in increasing technological knowledge and how to integrate technology by merging technological pedagogical and content knowledge in the context of early childhood education. The third component is defining the unit of analysis or case. This case
included a collective of early childhood educators with varying technological knowledge (TK) as the single-case. Defining the case is critical to the research design as it guides the research questions as well as how data will be collected and analyzed. The fourth component is linking data to the proposition that foreshadows data analysis. In this case, the analytic strategy started with existing data. Initial coding provided ways to organize the data into different arrays and categories. This initial coding also provided information to assist formulating the follow-up interview questions. The follow-up interviews addressed the theoretical proposition by focusing on the TPACK framework and affective domain taxonomy. The fifth component is the criteria for interpreting findings. Yin (Yin, 2014) suggests examining plausible rival explanations. In this case, the findings from data analysis were examined to reveal appropriate rival explanations for interpreting the findings.

**Conceptual Framework**

The exploratory case study data were initially collected without the TPACK framework in mind. However, when existing data were analyzed using the initial coding and holistic coding methods, some preliminary themes emerged (Saldaña, 2009). These preliminary themes provided general guidelines for the possible case study proposition that the characteristics of early childhood educators, the affective domain for learning, and developmentally appropriate practices play an important role in analyzing the TPACK framework. This concept is represented in Figure 5.

The TPACK conceptual framework emerged after investigating what the affordances of iPads are using existing data collected during the grant period. Based on initial results in which the focus of the study was exploring both how and why technological knowledge was gained by the participants, it was revealed that the affective domain for learning played an important role in integrating technological, pedagogical, and content knowledge. The initial coding and literature review supported the proposition that the characteristics of early childhood educators, the affective domain for learning taxonomy, and developmentally appropriate practice influenced how technological knowledge and skills were elevated throughout the project timeline and activities.
With the insights gained from the initial review of existing data, all data (both initial and follow-up) were recoded with the conceptual framework in mind. Further, follow-up interviews were undertaken with the conceptual framework in mind to add depth to understanding the teachers’ knowledge and skills.

**Figure 5. The TPACK framework in early childhood education (ECE) context**

### Participants and Context

#### Participants

Prior to starting the grant project, an IRB application was submitted and approved through Chaminade University of Honolulu. This process included getting consent forms signed by the participants. In addition to the initial IRB process, another IRB application was submitted through University of Hawai‘i at Manoa and approved prior to conducting the follow-up interviews with the participants. Additional consent forms were distributed and signatures were obtained prior to the follow-up interviews. The original letters of approval and consent forms are included in Appendix A.

The nature of the qualitative paradigm calls for non-probability sampling in selection of the participants. The participants were selected from several volunteers who were willing to participate in iPad workshops, spend time in exploring iPad use in the classroom, and were willing to be interviewed and observed.
A purposive sample is a non-representative subset of some larger population, and is constructed to serve a very specific need or purpose. A researcher may have a specific group in mind, such as high-level business executives. It may not be possible to specify the population as they may not all be known, and access will be difficult. The researcher attempts to zero in on the target group, interviewing whoever is available (Yin, 2014).

The selection process of the participants was a purposive sampling since the four teachers were selected using specific criteria for the purpose of exploring how they used iPads for assessment, teaching, and learning. In addition to their willingness to participate, the four participants needed to have differences in technological knowledge. It was also important that the teachers begin with established pedagogical and content knowledge. This meant that the teachers needed to have some teaching experience rather than being brand new teachers. These variations in composition of the teachers helped us explore the viability and appropriateness of this approach and how different demographic characteristics may impact the use and effectiveness of technology-aided teaching in preschool setting.

Differences in characteristics among the participating preschool teachers included technology literacy level, technology comfort level, and teaching experience. These variations in composition of the teachers helped us explore the viability and appropriateness of this approach and how different demographic characteristics may impact the use and integration of technology in preschool setting.

The pre-survey from the existing data provided some general characteristics of the participants and their initial self-rated technological proficiencies as shown in Table 4. Pseudonyms for the teachers and the schools are used throughout this report to ensure participant anonymity.

**Table 4. Characteristics of Participants Related to Technology**

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Years of Teaching</th>
<th>iPad Proficiency</th>
<th>Computer Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jennifer Park</td>
<td>32</td>
<td>Novice</td>
<td>Novice</td>
</tr>
<tr>
<td>Nina Chang</td>
<td>9</td>
<td>Intermediate</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Kristina Nakamura</td>
<td>34</td>
<td>Novice</td>
<td>Novice</td>
</tr>
<tr>
<td>Hannah Nystrom</td>
<td>35</td>
<td>Intermediate</td>
<td>Proficient</td>
</tr>
</tbody>
</table>
Study Setting

The targeted participants included four preschool teachers from MR Preschool (a pseudonym). MR Preschool is one of seven preschools operated by MMCC Preschools of Hawai‘i. MR Preschool serves primarily low-income families and the school has approximately 134 students ranging in ages between two to five.

Instrumentation and Procedures

The instruments used for this exploratory case study were surveys, interviews, observations, and documentations. Pre- and post-surveys, focus group interviews, informal interviews, observations, and documentations were used to answer the first research question. Although the data were collected in the year before the grant project, in-depth analyses of the data were not made at that time.

For this study, in-depth analysis provided broader understanding of the affordances of how iPads can be used for preschool teachers. In addition, follow-up interview questions were developed to address the second research question. The follow-up research questions provided discoveries within the TPACK framework. These follow-up interview questions were based on TPACK survey questions developed by Schmidt, Baran, Thompson, Koehler, Mishra, & Shin (2010) as well as survey questions used in two other studies (Archambault & Crippen, 2009; Chuang & Ho, 2011). The purpose and classification of various instruments are described in Table 5.

Table 5. Purpose and Classification of Instruments

<table>
<thead>
<tr>
<th>Instrument(s)</th>
<th>Classification</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-survey</td>
<td>Demographic, TK</td>
<td>Provided baseline information of participants</td>
</tr>
<tr>
<td>Documentation</td>
<td>Affective, TK, TCK, TPK</td>
<td>Provided codes for affective, TK, TCK, TPK</td>
</tr>
<tr>
<td>Observation</td>
<td>Affordance, Affective, TK, TCK, TPK</td>
<td>Provided codes for affordances, affective, TK, TCK, TPK</td>
</tr>
<tr>
<td>Group interview</td>
<td>Affective, TK, TCK, TPK</td>
<td>Provided codes for affective, TK, TCK, TPK</td>
</tr>
<tr>
<td>Post-survey</td>
<td>Affordance, Affective,</td>
<td>Provided codes for affordances,</td>
</tr>
</tbody>
</table>

Data Collection

In preparation for the data collection, two steps were taken at the beginning of the grant project. First, my role as the researcher was carefully examined including avoiding bias and keeping “contextual sensitivity” throughout the study (Nunes et al., 2010, p. 73). Second, to ensure the study was conducted ethically, an IRB was submitted and approved. The consent forms were distributed to the participating teachers and signed forms were collected prior to starting the research.

As mentioned earlier, there were two types of data. One was existing data from the grant project. The second set of data was the follow-up interviews of the teachers focusing specifically on the relevant TPACK questions.

The surveys consisted of three types: pre-survey, post-survey, and a follow-up survey. All surveys were administered online and emails were sent to the participants reminding them to complete the surveys by a due date. The primary purpose for the pre-survey was to establish a baseline for their technological knowledge (TK), their demographics, their understanding of the project, and their concerns or desires for learning technology. The post-survey documented change in the teachers’ technological knowledge (TK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK). Finally, the follow-up survey provided information regarding sustainability and applicability of their integration of technology in their current and future practice.

The interviews consisted of two types. A group interview was conducted at the end of the iPad workshops and follow-up interviews were conducted at the end of May 2014. The group interview was semi-structured and provided opportunity for the participants to share their responses to the three questions. The questions for the follow-up interviews were constructed after initial coding of the existing data.
The observations in the classrooms were conducted over two days. Another investigator and I observed four classrooms at different times during those two days. This established validity and reliability through investigator triangulation (Denzin, 1984).

The documentation was collected on different occasions. The main documentation consisted of the three iPad workshops conducted by three investigators. The recordings of the workshops were transcribed and field notes were coded for in-depth analysis.

The comprehensive process involving data collection and analysis is illustrated in Figure 6. Analysis of existing data using exploratory methods was the basis of the follow-up interview questions. Exploratory and affective methods were used to analyze the follow-up interviews and a second cycle of coding determined in-depth analysis of all the data.

Figure 6. Data collection and analysis

The methods of data collection for the existing data consisted of online pre-survey, post-survey, follow-up survey, group interviews, classroom observations, and documentations of iPad workshops and other email correspondence. The pre-survey was collected in January 2013. The first two iPad workshops were documented in February and March 2013 respectively. The classroom observations were recorded in April 2013,
followed by the third iPad workshop and group interviews that were conducted in May 2013. The post-survey data were collected in June 2013, and the follow-up survey data were collected in August 2013.

The new data collection consisted of in-depth follow-up interviews. Four interviews were scheduled at the end of May 2014. The initial coding and holistic coding of the existing data helped to develop interview questions for follow-up interviews.

The data were coded using a computer-assisted qualitative data software (CASDAQ) program, HyperRESEARCH. Using exploratory and affective methods, this software was used to code the follow-up interviews (Lewins & Silver, 2007; Saldaña, 2009).

**Data Analysis**

The data analysis included data management, initial analysis, and higher-level analysis. In order to ensure proper management of the data collected for this study, all data were organized chronologically into a spreadsheet.

As explained in the previous chapter, the data consist of existing data and new data. For both existing and new data, codings were applied in two cycles. During the initial coding cycle, holistic and provisional coding methods were used, and in the second coding cycle, exploratory and affective coding methods were used (Saldaña, 2009).

The existing data were collected and analyzed during the grant project that provided some pre-coding information. Although CAQDAS was not used for this purpose, the researchers involved in the grant project noticed words, phrases, and concepts that stood out. However, since the purpose of the grant project was exploring iPad affordances, the focus was mainly looking at themes regarding iPad affordances. In addition, this grant project did not require researchers to provide an in-depth look at analyzing the data but rather the initial impression of the study. Detailed description of this categorization can be found in Table 6 below.

**Table 6. Initial Coding and Brief Descriptions**

<table>
<thead>
<tr>
<th>Categories</th>
<th>Codes</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective</td>
<td>Receiving</td>
<td>Participant’s awareness and willingness to use</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Responding</td>
<td>Participant’s active participation, attention, and reaction to technology</td>
<td></td>
</tr>
<tr>
<td>Valuing</td>
<td>Participant’s worth or value attached to technology</td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>Participant’s organization of values into priorities by comparing, relating, and synthesizing values</td>
<td></td>
</tr>
<tr>
<td>Characterization by value</td>
<td>Participant’s general patterns of adjustment due to internalizing values</td>
<td></td>
</tr>
<tr>
<td>Affordance</td>
<td>Assessing</td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>Participant’s technology use for teaching</td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td>Participant’s technology use for learning</td>
<td></td>
</tr>
<tr>
<td>TPACK</td>
<td>TK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s technological knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s pedagogical knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s content knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TPK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s technological pedagogical knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TCK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s technological content knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PCK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s pedagogical content knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TPACK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant’s technological pedagogical and content knowledge</td>
<td></td>
</tr>
</tbody>
</table>

The shift from initial impressionistic to more in-depth analysis of the data required preliminary examination of the existing data. First, a grand perspective on the “units of social organization” (Saldaña, 2009, p. 14) was examined. Second, evaluating which data to include and how much data to include were examined. Third, the condition of the data was evaluated for accuracy, consistency, and formatting in order to prepare for CAQDAS. In this study, HyperRESEARCH CAQDAS was used to analyze the data.

The data analysis included four steps. First, the existing data were analyzed to create follow-up interview questions. Second, the existing data were analyzed using categories of affordances, affective, and TPACK. Third, the new data were analyzed using affordances, affective, and TPACK categories. Finally, all data were re-examined to develop themes and determine the relationship between affective and TPACK categories.

**First Cycle Coding**

The data consisted of collection of documents, interviews, surveys, and observations. Data collected through recordings such as group interviews, individual
interviews, and workshops were transcribed before the initial coding. The first cycle of coding involved two steps. The first step involved holistic coding method using only the existing data. From this coding, more focused interview questions were developed for the follow-up interviews. The second step involved a provisional coding method to create the three major coding categories of affordances, affective, and TPACK. The table below provides initial coding with brief descriptions under those three major categories.

**Table 7. First Cycle of Coding**

<table>
<thead>
<tr>
<th>Affordances</th>
<th>Affective</th>
<th>TPACK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Affordances-assessing</strong> (affordances using iPad/technology for assessing)</td>
<td>Affective-receiving (being aware, willingness to receive information about iPad/technology use)</td>
<td>TPACK-PK (teacher knowledge about a variety of instructional practices, strategies, and methods to promote students’ learning)</td>
</tr>
<tr>
<td><strong>Affordances-learning</strong> (affordances using iPad/technology for learning)</td>
<td>Affective-responding (willingness to respond to iPad/technology use)</td>
<td>TPACK-CK (any subject-matter knowledge that a teacher is responsible for teaching)</td>
</tr>
<tr>
<td><strong>Affordances-teaching</strong> (affordances using iPad/technology for teaching)</td>
<td>Affective-valuing (acceptance of a value, preference for a value, or commitment)</td>
<td>TPACK-PCK (how particular contents are appropriately designed for instruction)</td>
</tr>
<tr>
<td><strong>Affordances-access</strong> (access related to using iPad/technology)</td>
<td>Affective-organization (conceptualization of a value or organization of a value system into philosophy)</td>
<td>TPACK-TK (knowledge about technology that can be integrated into curriculum)</td>
</tr>
<tr>
<td><strong>Affordances-autonomy</strong> (autonomy when using iPad/technology)</td>
<td>Affective-characterization (generalization of value system or integration of a value system into lifestyle)</td>
<td>TPACK-TPK (an understanding of technology can constrain and afford specific pedagogical practices)</td>
</tr>
<tr>
<td><strong>Affordances-community of learners</strong> (building community of learners)</td>
<td>Adjustment (adjustment in value of iPad/technology for assessing, teaching and learning)</td>
<td>TPACK-TCK (knowledge of the reciprocal relationship between technology and content)</td>
</tr>
<tr>
<td><strong>Affordances-easy use</strong> (easy to use iPad/technology)</td>
<td>Appreciation (appreciating use of iPad/technology; similar to valuing)</td>
<td>TPACK (knowledge about the complex relations among technology, pedagogy, and content that enable teachers to develop appropriate teaching strategies)</td>
</tr>
<tr>
<td>Affordances-effective (effective when using iPad/technology)</td>
<td>Attitude (attitude towards the use of iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Affordances-efficient (efficient when using iPad/technology)</td>
<td>Commitment (committing to the use of iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>Affordances-engage (engagement when using iPad/technology)</td>
<td>Confidence (confidence level in using iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>Affordances-enhance (enhancing learning when using iPad/technology)</td>
<td>Confusion (confusion in using iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>Affordances-inconvenience (inconvenience when using iPad/technology)</td>
<td>Embarrassment (embarrassed about their lack of knowledge in using iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>Affordances-management (management of iPad/technology)</td>
<td>Enthusiasm (enthusiastic about their knowledge in using or using iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>Affordances-mobility (mobility when using iPad/technology)</td>
<td>Fear (fearful about using iPad/technology for assessing, teaching, and learning)</td>
<td></td>
</tr>
<tr>
<td>Affordances-motivation (motivation when using iPad/technology)</td>
<td>Frustration (frustrated about using iPad/technology for assessing, teaching, and learning)</td>
<td></td>
</tr>
<tr>
<td>Affordances-parent communication (parent communication using iPad/technology)</td>
<td>Sharing (sharing knowledge about iPad/technology)</td>
<td></td>
</tr>
<tr>
<td>Affordances-peer learning (peer learning when using iPad/technology)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affordances-policy (policy related comments when using iPad/technology)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affordances-teacher resource (using</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The first cycle of coding used affordances, affective, and TPACK categories. The subcategories for affordances were assessing, learning, teaching, and additional codings under “other” subcategory. The subcategories for affective were the five levels of affective domain taxonomy (Krathwohl et al., 1964) and additional codings collectively clustered under “other” subcategory. The subcategories for TPACK consisted of the seven components in the TPACK framework (Koehler et al., 2014) with additional attention to technology related components divided up into iPad technology and general technology. Figure 7 provides a visual look at the categories and subcategories after the first cycle of coding.
For reliability, three colleagues reviewed samples of the first cycle codings. The feedback provided by the colleagues were consistent with the initial codings but there was some confusion with the code descriptions. Thus, the descriptions were updated and other comments were incorporated into the coding process.

**Second Cycle Coding**

After several iterations of the first coding cycle, many codes were consolidated, deleted, and revised. In the second cycle, the assumptions regarding the participants were reviewed and subcategories were updated as indicated in Figure 8.

---

**Figure 8. Second cycle coding categories and subcategories**

There were three assumptions made prior to data analysis. The first assumption in regards to affective domain taxonomy is that the participants had already surpassed the initial two levels of the taxonomy, which are receiving and responding levels. The simple fact that the teachers agreed to participate in the study demonstrated that they were not only conscious of the challenges of technology integration in the context of early childhood but they were willing to respond to that awareness. The second assumption is that the participating teachers in this study were assumed to have high levels of pedagogy and content knowledge in the context of early childhood education.
This assumption was made because all the teachers had extensive teaching experience. The third assumption is that the affective domain taxonomy operates on a continuum. The nature of human affect is never in a vacuum but rather in a continuum at various levels. The first two assumptions were confirmed after first cycle of coding, therefore we eliminated the affective subcategories of receiving and responding. For the same reason, the TPACK subcategories, PK, CK, and PCK were eliminated so this study could focus primarily on the technological knowledge and its relationship to content and pedagogical knowledge.

**Validity**

The research strategy to establish formal validity in case study is referred to as triangulation (Feagin et al., 1991). Stake (1995) indicates the need to triangulate in order to validate the data collection and analysis processes. There are four types of triangulation according to Denzin (1984). Among data source triangulation, investigator triangulation, theory triangulation, and methodological triangulation, the existing data for this grant project was fortunate to establish data source and investigator triangulation. This study afforded multiple sources of evidence and three investigators to collect and analyze the data.

**Summary**

This exploratory single-case study answered two research questions by using coding methods of data analysis in two cycles. The data being used for this analysis included existing data from a grant project completed at the end of 2013 and new data from follow-up interviews completed in May 2014.

The method of data analysis was coding in two cycles and the findings of this study are discussed by themes with narrative analysis of the data in the following chapter. This case study explored affordances of iPads with four preschool teachers and how their technology integration occurred within the TPACK framework.

The following chapter will provide detailed information on the findings and Chapter 5 further discusses the findings as well as implications for findings and recommendations for future research.
CHAPTER 4. FINDINGS

This exploratory single-case study attempts to answer two research questions by using coding methods of data analysis in two cycles. The data being used for this analysis include existing data from a grant project completed at the end of 2013 and new data from follow-up interviews completed in May 2014.

This chapter discusses the theme development as a result of the data analysis after the first and second cycle of codings.

Affordances

The coding analysis revealed the following affordances of the iPad in pre-determined subcategories of assessing, learning, and teaching. The notable themes that emerged from affordances category are listed in Table 8.

Table 8. Themes in Affordance Subcategories

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Second Cycle Coding</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing</td>
<td>efficient time</td>
<td>The iPad GOLD® assessment app afforded an efficient way to assess in the classroom.</td>
</tr>
<tr>
<td></td>
<td>accessibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ease of use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>effective</td>
<td>The iPad GOLD® assessment app afforded an effective way to assess in the classroom.</td>
</tr>
<tr>
<td></td>
<td>accurate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>frequent</td>
<td></td>
</tr>
<tr>
<td>learning</td>
<td>efficient time</td>
<td>The mobility, accessibility, easy usability of the iPad afforded efficient learning opportunities for children.</td>
</tr>
<tr>
<td></td>
<td>accessibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ease of use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>effective</td>
<td>The engaging, enhancing, interactive, and motivational learning opportunities using the iPad afforded effective learning for children.</td>
</tr>
<tr>
<td></td>
<td>engage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>enhance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>interactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>motivational</td>
<td></td>
</tr>
</tbody>
</table>
learning from the children

The teachers noticed children had high technological knowledge and they were **learning from the children**.

peer learning

The teachers noticed **peer learning** when they used the iPad in a small group.

teaching
efficient
mobility
accessibility
ease of use
effective
teachable moment
teaching guide
teaching resource

The mobility, accessibility, easy usability of the iPad afforded **efficient teaching opportunities** for teachers.

teaching
effective
teachable moment
teaching guide
teaching resource

The iPad used for teachable moment, teaching guide and as a teaching resource afforded **effective teaching opportunities** for teachers.

policy
management

The iPad affordance related to **policy and management** of how iPads are used in the classroom.

There were some common themes across the three subcategories and some that were unique to each subcategory. The two themes that were common across the three subcategories were ways technology provided effective and efficient ways to assess, learn, and teach.

**Assessing**

The efficiency aspect of the technology for these teachers was associated primarily with the GOLD® assessment system app where many stated it was a timesaving tool. In addition, comments associated with efficiency included convenience of mobility and accessibility as well as ease of use. Nina expressed during observation that the “iPad helped her save a lot of time especially with GOLD assessment and record keeping.”

When asked about how they would use the iPad for assessing, Kristina expressed, “Taking more documentations using the teaching strategies app on the iPad and being able to take on the spot pictures. I want to start using more apps to help with the assessment of children” and Jennifer stated, “Being able to carry it around and document things faster, accurately and more efficiently. I will be able to take photos and add
observation notes as I see things happen. Being able to use different apps like Teaching Strategies and taking photographs or recordings to document for assessments.”

In terms of effectiveness in assessing, the GOLD® assessment system app enhanced accuracy and frequency. Assessments were accurate since the teachers were able to record at real-time instead of recording from memory and the convenience of mobility and accessibility led to more frequent recording of children’s progress. The observation field note indicated “[Nina] uses [iPad] extensively for GOLD® app. [Nina] seems to use iPad all the time whenever needed in the classroom as an assessment tool and record keeping. She takes pictures with GOLD® app and upload to online system to add additional information for each child.” Figure 9 illustrates ways teachers used the GOLD® app. The photo on the left provides how one teacher took a photo directly on the app so it can be saved in the system rather than taking the time to upload it later if she had to take the photo with a camera. The photo on the right illustrates how mobility and accessibility afforded a teacher to record an assessment of student work at real-time. The teacher is taking a photo and comments directly in the GOLD® app as children completes their journal work.

Figure 9. Examples of how teachers used the GOLD® Assessment System app

Learning

The affordance of effective learning subcategory included the children’s ability to engage learning, enhance learning, interact with learning materials, and motivate learning using the iPad. Learning subcategory within the affordance coding focused on two different groups. One group focused on learning for children and the other group focused on learning for teachers.
One notable theme in learning for children was peer learning. For example, Jennifer expressed that she was excited to see how children “helped each other” when they used the alien assignment app within a small group. She said, “...so it was interactive and they [the children] knew, they were all talking together, it just wasn’t some one person activity, they all helped each other”. Hannah expressed “So it’s neat because they work together” when children in her classroom worked on a math app within a small group. In the observation field note, four incidents of peer interaction among the children were recorded. Figure 10 provides two photos of how children gathered and helped each other as they used various apps on the iPad.

Figure 10. Examples of peer learning for children

The peer learning theme also emerged in relation to learning for teachers. The shared learning among teachers was apparent in the conversation during their iPad workshops. Hannah shared an app she used in the classroom and both Jennifer and Kristina asked the name of the app so they could also try it out. There was also other technical knowledge shared at the workshop as well as during the group interview. During the follow-up interview, Jennifer and Nina commented how much they appreciated learning from each other. Jennifer commented, "Everyone was helping each other and some people know more and it felt good when I could help somebody" and Nina expressed, “when we came together to collaborate stuff about what we could do, how we’re using it, getting ideas about what they did, it was really nice to hear because how one teacher used it is not necessarily the same as how I used it”.

The teachers learned from their peers (other teachers) but they also learned from the children. The teachers recognized children’s advanced ability to use technology. Participants indicated that they learned from the children on how to use technology and some of them were impressed with how much the children already knew about
technology and how to use the iPad. For example, Jennifer reported that a child in her class taught her how to slide the iPad screen and how to press the home button when apps started to “wiggle”. When she was describing how the children used the iPad, she said “It’s so neat, it’s like they [the children] automatically know”. Nina said, “So they knew more about the iPad than I did, so they were teaching me”. Kristina expressed during group interview, “…this other girl goes, ‘It’s loading’. So they were bringing the vocabularies in”.

**Teaching**

There was a notable emphasis on effectiveness for teaching, which included teachable moments, teaching resources, and teaching guides. This emphasis by teachers on effectiveness in teaching was indicative in the frequency of coding applied at the second cycle as shown in Table 9.

**Table 9. Coding Frequency Applied to Common Themes across Subcategories**

<table>
<thead>
<tr>
<th>Themes</th>
<th>Affordance-Assessing</th>
<th>Affordance-Learning</th>
<th>Affordance-Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>efficient</td>
<td>36</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>effective</td>
<td>17</td>
<td>68</td>
<td>85</td>
</tr>
</tbody>
</table>

Despite the focus on assessment in the project, the teachers’ most exciting learning was in understanding how technology could be used to meet immediate learning needs in the classroom as these arose. The anytime-anyplace access to a wealth of information and resources of a mobile device was highly valued.

In the post-survey open-ended questions, teachers reported their new understanding of the ability to call up information on demand to immediately respond to teachable moments by using a mobile device. Some examples given of useful resources were images and YouTube videos. They noted they were able to show things that probably most Hawaii students would not have experienced, with examples including weather and snow, or animals like a buffalo. In one case this allowed a response to a student question to which the teacher didn't know the answer but could immediately look it up. Of particular interest was one response in which the teacher suggested having the iPad increased technical resources in the classroom to match the home technology
students were already using. Kristina said, "I like how I'm able to look up things and show the children what we're talking about or look up information if I don't know the answer. When we were talking about weather, I found a website on snow falling and we were able to watch snow falling and a car being covered up by all the snow." She also commented in the post-survey, “I can share information and pictures to children ASAP. [For] example, I was reading a story; a buffalo was in the story. One of the students asked, ‘what is a buffalo?’ I was able to look on the Internet right away and pull up pictures of a buffalo.”

Figure 11 illustrates two examples of teachers using the iPad as a teaching resource. The photo on the left shows one of the teachers sharing a photo that relates to the topic they are learning. The photo on the right illustrates “just-in-time teaching” where one of the teachers is looking up a video during circle time in response to a question from a student.

Figure 11. Examples of effective ways to use iPad

For the teaching subcategory, an additional theme concerning the school policy for technology surfaced. There was some confusion as to how to use the iPad in terms of current policy that teachers viewed as restricting them from using it effectively. One additional theme in teaching was associated with the teachers’ management and pedagogical strategies for iPad use in the classroom.

The general themes discovered in this affordance category can be seen as being at what Boyatzis (1998) termed the “manifest level” rather than “latent level.” Boyatzis (1998) explains manifest level as “directly observable in the information” and latent level as “underlying the phenomenon”. Auerbach and Silverstein (2003) further define the manifest level as “an implicit topic that organizes a group of repeating ideas” (2003, p. 38). As is suggested in the above examples, the teachers themselves could easily
describe affordances and recognized them as benefits, making it easy to identify these codes in the data.

**Affective Taxonomy**

The second cycle of coding for affective taxonomy analyzed both existing and new data. After confirmation of the assumptions mentioned above, codings were merged and revised during the second cycle, which developed into themes. Table 10 provides summary of the themes that emerged within each affective subcategories.

**Table 10. Themes in Affective Subcategories**

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Second Cycle Coding</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>valuing (AV)</td>
<td>acceptance of a value preference of a value commitment</td>
<td>The teachers’ valuing affective level <strong>progressed</strong> from acceptance of a value level to commitment level <strong>over time</strong>.</td>
</tr>
<tr>
<td>organization (AO)</td>
<td>conceptualization of a value organization of a value system attitude change confidence beliefs</td>
<td>There were <strong>change</strong> in teachers’ attitude, confidence, and beliefs <strong>over time</strong>.</td>
</tr>
<tr>
<td>characterization by value complex (AC)</td>
<td>generalized set characterization sharing knowledge</td>
<td>The teachers’ use of iPad and technology <strong>beyond school environment</strong> changed <strong>over time</strong>.</td>
</tr>
</tbody>
</table>

**Affective-Valuing (AV)**

Krathwohl, Bloom, and Masia (1964) describe valuing as “behavior categorized at this level is sufficiently consistent and stable to have taken on the characteristics of a belief or an attitude” (1964, p. 139). This value is divided into three sub-levels. First sub-level is acceptance of a value, second sub-level is preference for a value, and the third sub-level is commitment. In second cycle of coding, codes that were assigned to valuing were reassigned as one of the three sub-level categories.

**Acceptance of a value.** This is the first step to valuing affective taxonomy. This level is described as “the ascribing of worth to a phenomenon, behavior, object, etc.”
(Krathwohl et al., 1964, p. 139). The common term “belief” is considered an adequate term at this level according to Krathwohl, Bloom, & Masia (1964). There were a total of 47 counts of affective-valuing codes assigned to the data and among them, the codes that were assigned to acceptance of a value coincided with comments that acknowledge the importance of knowing more about technology as a teacher. Teachers also expressed recognition of technology ubiquity even for very young children. Jennifer wrote, “As the nation and the world is developing and improving the technology that we use, I feel it is important to expose the children, but also keep a balance of this technology and ‘the basics’ to ensure the development in their fine motor and manipulative skills”.

**Preference for a value.** According to Krathwohl, Bloom, and Masia (1964), preference for a value is the next level within the valuing affective taxonomy. This is the “intermediate level of involvement between the acceptance of a value and a full commitment to it” (p. 145-146). The teachers expressed how much they appreciate being part of the grant project as well as wanting to learn more about using the iPad. Kristina wrote, “I’m a Pre-K teacher and this is very new to me, so anything I learn will be good”.

**Commitment.** This is the highest level within the valuing affective taxonomy. Krathwohl, Bloom, and Masia (1964) associates “conviction” and “certainty beyond a shadow of a doubt” to describe this level (p. 149). Initially teachers expressed they wanted to learn certain skills or knowledge on how to use the iPad but during the post-survey, they expressed how they wanted to continue the grant project so they can continue to learn. They were certainly committed to learning more about technology. Nina said, “I think that what I am doing with the iPad is just the tip of an iceberg. There must be more that I can do with the iPad that I am unaware of”.

**Affective-Organization (AO)**

In the affective domain taxonomy, this level takes on a new platform “as the learner successively internalizes values” (Krathwohl et al., 1964, p. 154). There are two sub-levels to the organization taxonomy. First sub-level is conceptualization of a value and second sub-level is organization of a value system.

**Conceptualization of a value.** At this level, conceptualization is added to consistency and stability in valuing taxonomy (Krathwohl et al., 1964, p. 155). During
the workshop, Kristina expressed, “I think that’s one of the things that makes it really neat” as she explained how useful the iPad was in providing “just in time” teaching. The teachers not only consistently value the use of the iPad but applying “higher-level cognitive behavior such as Analysis and Synthesis” (Krathwohl, Bloom, and Masia, 1964, p. 154). The teachers recognized various values to using the iPad by discovering different affordances and appropriate uses. This was apparent during group interviews as they explained different ways they were using the iPad for assessing, teaching, and learning. In addition, during the post-survey, all four participants indicated that they strongly agree to using the iPad in their future teaching.

**Organization of a value system.** In organization of a value system, the teacher puts the conceptualization of a value into “an ordered relationship” (Krathwohl et al., 1964, p. 159). Teachers were beginning to prioritize the appropriate use of the iPad particular to their own classroom. Although all the teachers recognized and prioritized using the iPad for assessing, different teachers had different priorities when it was used for teaching and learning. For example, Kristina who teaches three-year-olds did not provide much time for children to use the iPad for learning but she used it often as a teaching tool to enhance a lesson. This was quite evident in the follow-up interviews. Contrary to Kristina, Hannah who teaches four-year-olds and five-year-olds expressed how she allowed children to choose the iPad apps throughout the class time. She gathered all the iPads and provided a center where children were allowed to choose as one of the activities in the classroom.

**Affective-Characterization by Value Complex (AC)**

This is the highest level of affective taxonomy. At this level, the value is not only prioritized in the value system but also consistently used where the application of the value is no longer a conscious effort (Krathwohl et al., 1964, p. 164). Another term used for this level is “lifestyle” (Krathwohl et al., 1964, p. 170).

**Generalized set.** This is the behavior component to characterization by a value or value system level. Another way to explain this level is as “a basic orientation which enables the individual to reduce and order the complex world” (Krathwohl et al., 1964, p. 166). Attitudes, values, and beliefs are related to this basic orientation. The data
revealed that attitudes, values, and beliefs impacted their decision to experiment with various affordances. They increased the amount of time spent on their iPads but also were more open to using iPads in various ways.

**Characterization.** This is the ultimate level where the behavior and thought becomes part of a person’s lifestyle such that the attitudes, values, and beliefs are applied at an unconscious level (Krathwohl et al., 1964, p. 171). The teachers did not quite reach at this level but there were indications of moving towards this direction. For example, Kristina and Hannah indicated that they use the iPad beyond the classroom. Kristina used iPad not only for teaching and learning but also for personal use such as reading, organizing, and playing games. Hannah who reported having proficient computer skills and intermediate iPad skills in the pre-survey, also showed progression towards this level.

**Change over time.** The general theme that emerged in this coding indicated change in the teachers’ affective domain over time. There was a progression over time to move from valuing affective level towards characterization by value complex over the year and a half timeframe. This included change in teachers’ attitudes, confidence, and beliefs about iPad affordances and appropriate integration. In addition, teachers started to use the iPad beyond assessing, teaching, and learning and extend to their personal use. Nina commented in the post-survey, “Changing my attitude of using technology in the classroom. I had my doubts, but now I can see that by using the iPad, the children can also develop their eye hand coordination, concentration and confidence.”

The timeline for when each affective taxonomy level occurred was determined by where the coding occurred. Table 11 provides frequency of coding applied to each different types of data.

<table>
<thead>
<tr>
<th>Data</th>
<th>Affective-Valuing (AV)</th>
<th>Affective-Organization (AO)</th>
<th>Affective-Characterization (AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-survey</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>iPad workshop</td>
<td>16</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Observation</td>
<td>1</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Group interview</td>
<td>19</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>
As indicated in the table above, the majority of the valuing codings occurred during the iPad workshop and Group interview but organization codings occurred in the follow-up interview. Similarly, the largest number of characterization codings occurred in the follow-up interview. For example, teachers often expressed enthusiasm and appreciation during the iPad workshops such as “Well, that was a great demonstration!” or “I was so happy [to have learned how to use an iPad feature] and excited to come to work to tell my team teacher.” or “Again, that was a useful one because when you’re carrying this around, every time you tip it, it’s gonna start moving, so if you’re using it with a class or you’re working on something, by doing that it will stay stable.” However, in the follow-up interviews, teachers were clear about the value of iPads in the classroom. Jennifer who self-rated as a novice user, stated during the follow-up interview, “I love it! I was really hesitant because, I wasn’t experienced with it. For me, I said, this is the children’s world and I said, I want to keep up with it. And I said, there’s someone I used to work with and she’d say I can’t be bothered, I can’t be bothered, and I said I didn’t want to be like that.” Nina, who is now a director at one of the campus sites, commented during the follow-up interview, “I think it’s very beneficial to have [iPad] in the classroom, just cause like right now my teachers are doing it…they’ve been saying they’ve been noticing such progression just in the way that the children are learning and retaining the information on the iPad.” Hannah commented, “…anytime anything new, you have fear for almost anything new. And here was the iPad, I had to get used to it, so I was a little fearful of that and what I was able to play with…I think in the beginning it was a lot of fear to where now I feel pretty confident and pretty comfortable with it.” Kristina, when sharing the value of the iPad in the classroom, commented, “I think using the iPad in the discussions and bringing--like when we were planting wheatgrass, you know so they can see the wheatgrass from the time lapse, just bringing that world to them.”

While teachers each recognized the value added to using the iPad in the
classroom, the post-survey open-ended questions revealed that there were distinct differences in learning styles among teachers: one preferred to research herself. By contrast another teacher preferred specific lessons and instructions. All appreciated opportunities for discussion during the workshops with the other teachers and wanted more of this as a focus of professional development. In general, they said the professional development (PD) opportunities were too short and not enough. They also noted that one advantage to the grant was the chance to get together to talk about the iPad uses and that this would be hard to do without release time. In regards to PD, teachers commented, "More meetings to share would be nice! (We aren't able to meet at school, because of coverage and just finishing up our daily tasks.)" and "I like hands on experience so I think it would be good to share different apps at the meetings so that they could try them." The teachers learned best when given the opportunity to share with each other and explore independently. However, for the most novice user more formal "how to" instruction was needed as well. Time was important for learning, particularly release time for talking and professional development.

**TPACK Framework**

As mentioned earlier, the participants of this study were assumed to have sufficient content and pedagogical knowledge due to their long teaching experience. Therefore, during the second cycle of coding Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK) codings were dropped and the theming of data focused primarily on Technological Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical and Content Knowledge (TPACK). Table 12 provides a summary of the second cycle of coding and the themes that emerged from them.

**Table 12. Themes in TPACK Subcategories**

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Second Cycle Coding</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK</td>
<td>TK-iPad</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TK-technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TK-technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TK-assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The teachers’ technological knowledge <strong>increased over time.</strong></td>
</tr>
<tr>
<td>TCK</td>
<td>TCK-iPad</td>
<td>TCK-technology</td>
</tr>
<tr>
<td>-----</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>TPK</td>
<td>TPK-iPad</td>
<td>TPK-technology</td>
</tr>
<tr>
<td>TPACK</td>
<td>TPACK-iPad</td>
<td>TPACK-technology</td>
</tr>
</tbody>
</table>

**Technological Knowledge (TK)**

The second cycle of coding for Technological Knowledge consisted of technological knowledge related to the iPad (TK-iPad), Technological Knowledge related to general technology/computer skills (TK-technology), and Technological Knowledge related to assessment (TK-assessment).

The pre-survey included 6 Likert-scale questions on computer experience and based on self-ratings of overall computing skills, Hannah indicated that she is proficient, Nina indicated she is intermediate, Jennifer and Kristina reported to be novices. All of them reported having some level of familiarity with mobile devices and all have used Apple products such as iPhones, iPods, and iPads. Hannah reported she has three years of iPad experience and Kristina reported having one year of iPad experience. Nina, Kristina, and Hannah reported their self-rate on learning new technology as average whereas Jennifer indicated somewhat challenging.

Overall, the teachers had very diverse set of technology skills and knowledge. The post-survey indicated increases in technological skills and knowledge by teachers from the pre-survey. In response to the item, “confidence level in using technology and digital media to plan activities with young children,” three teachers agreed that they were confident and one teacher remained neutral. Similarly, in response to the item, “confidence level in using technology and digital media to teach digital literacy concepts to young children,” one teacher indicated strongly agree that she is confident, two
teachers agreed that they were confident, and one teacher remained neutral. In addition to Likert-scale responses, the open-ended responses such as following comments were indications of their increase in their technological skills along with their confidence in using technology.

*Hannah:* “I can share information and pictures to children ASAP. Example I was reading a story a buffalo was in the story. One of the students asked, ‘what is a buffalo?’ I was able to look on the Internet right away and pull up pictures of a buffalo.” In addition she also commented, “I can upload many child observations using the iPad. The iPad helps me look on the web for information and pictures to help children learn and explore their world.”

*Jennifer:* “I like how I'm able to look up things and show the children what we're talking about or look up information if I don't know the answer. When we were talking about weather, I found a website on snow falling and we were able to watch snow falling and a car being covered up by all the snow.” She also stated, “I never used an iPad before and I feel so fortunate to have had this opportunity. I really like how I can have visual information to show my class right away.”

*Kristina:* “Having a sample of the children's work is great to add to my observations, especially their writing and drawing samples. Pictures of their creations with blocks are great to keep and share with their parents at conference is awesome too! And it will follow the children to their next class.”

*Nina:* When asked what she took away from the project, she commented, “How to use the iPad to help with technology features to show the children and possibly use them in conference also.”

In regards to their self-rated iPad proficiency, all reported an increase but Jennifer remained as novice. Jennifer’s self-rated iPad proficiency remained the same as novice but coding indicated that technological knowledge regarding the iPad (TK-iPad) did increase for Jennifer. For example, when she first started this project, she reported that she did not use iPad in the classroom because “[She] might do something wrong to jeopardize the function of the iPad.” However, during observation, she was comfortably using iPad in the classroom. Figure 12 provides a photo of her using the GOLD® app on the left and working on an app with children on the right photo.
Nina and Hannah both increased iPad proficiency from intermediate to proficient and Kristina increased from novice to intermediate. Table 13 summarized this change in technological knowledge.

Table 13. Participants Related to Change in TK

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Years of Teaching</th>
<th>iPad Proficiency pre- to post-survey</th>
<th>Technological Knowledge (TK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jennifer Park</td>
<td>32</td>
<td>Novice to Novice</td>
<td>Increase</td>
</tr>
<tr>
<td>Nina Chang</td>
<td>9</td>
<td>Intermediate to Proficient</td>
<td>Increase</td>
</tr>
<tr>
<td>Kristina Nakamura</td>
<td>34</td>
<td>Novice to Intermediate</td>
<td>Increase</td>
</tr>
<tr>
<td>Hannah Nystrom</td>
<td>35</td>
<td>Intermediate to Proficient</td>
<td>Increase</td>
</tr>
</tbody>
</table>

**Technological Content Knowledge (TCK)**

Technological Content Knowledge (TCK) refers to knowledge of the reciprocal relationship between technology and content. Again, the second cycle of coding subdivided TCK into Technological Content Knowledge related to iPad use (TCK-iPad), Technological Content Knowledge related to general technology/computer skills (TCK-technology), and Technological Content Knowledge related to assessment (TCK-assessment). All the teachers used iPads for teaching and learning in the classroom for various curricular content. Hannah reported how she adjusted the iPad app for math when she worked with a younger child. Jennifer was observed to use iPad app to enhance children’s learning by providing interactive four season song at circle time and Kristina also used the iPad photos and videos to enhance learning about butterflies, numbers, and shapes. Nina used iPad apps that provided enhancement of vocabulary building and language development. Figure 13 shows examples of how the iPad was
used to enhance content knowledge. The first photo is an app Hannah used to enhance vocabulary building and letter formation. The second photo shows a child using the iPad app to practice her math skills.

![First photo](image1.jpg) ![Second photo](image2.jpg)

**Figure 13. Examples of TCK**

There were some differences in how the iPad and technology were used by each teacher. However, all the teachers used the iPad similarly when assessing different content knowledge of the children. Since all the teachers were trained in the GOLD® Assessment System, they used the GOLD® Assessment System app for assessment of the children’s progress. Although the frequency in use of GOLD® app varied by teacher, overall use of GOLD® app by all the teachers increased over time.

The general theme that emerged from the second cycle for TCK indicated that technological knowledge pertaining to various content increased over time and the majority of the teachers used technological knowledge to enhance content knowledge rather than as a main teaching method. One of the observation note stated, “[Hannah] uses iPad more and more everyday. She uses iPad for videotaping, photos, GOLD® app, literacy, math, and geography apps. She also takes pictures with camera, iPad, and iPhone.” Figure 9 provides some apps Hannah allowed children to practice vocabulary building and number sense after she gave lessons to the children using concrete materials.

**Technological Pedagogical Knowledge (TPK)**

Technological Pedagogical Knowledge (TPK) refers to an understanding of how technology can constrain and afford specific pedagogical practices. The subdivision of TPK also consisted of Technological Pedagogical Knowledge related to iPad use (TPK-iPad), Technological Pedagogical Knowledge related to general technology/computer skills (TPK-technology), and Technological Pedagogical Knowledge related to
assessment. As referenced in Chapter 2, the overarching pedagogy in early childhood education is in reference to Developmentally Appropriate Practice (DAP). The pedagogy is to use methods that are appropriate for the particular developmental level of the child. The general theme that emerged from TPK was all the teachers’ DAP integration of technological knowledge increased over time. Jennifer mentioned how her children used the iPad to take photos for an interactive app called, “Alien Assignment.” She said her three- and four-year-olds need handles that provide better grip when holding and carrying the iPad. Thus, she purchased an iPad case that was developmentally appropriate for her children. The photo on the left in Figure 14 illustrates how larger handles provided a secure grip for the child.

Nina expressed that she had to adjust how she worked with the children when she was trying out the storytelling app called, “Toontastic” during the observation visit. She realized that the multi-steps involved in creating a story through this app were too complicated for the young four-year-olds but for the older four-year-olds and five-year-olds, they were appropriate. In the follow-up interview, she noted that she adjusted how she presented this app when she worked with different age groups. She also experimented with the Educreation app to provide practice opportunities for her student to write his name as shown in Figure 14 photo on the right.

Figure 14. Examples of TPK

During group interview, Kristina mentioned how she adjusted her presentation of YouTube videos to children to make it appropriate. She said, “you kind of just have to play them on YouTube, cause some of them are longer than others, some of them are not clear, some of them are too long. So I kind of look for the time first, the short ones, and then you look to see who uploaded it, and you kind of look at their things, so I figured out how to save those [to my] playlist.” Kristina works with three-year-olds and
developmentally the children’s attention span at this age is limited, so she consciously chose videos that were the right length for that age group. She did indicate that initially she did not realize this but over time, she discovered how to integrate appropriately by experimenting with the iPad. She also indicated that she would not turn the iPad to show the children until she was able to skip the commercial on YouTube since most of the time, the advertisements were inappropriate for the young children.

Hannah was initially afraid to let the children freely carry the iPad in the classroom. However, towards the end of the project, she created an iPad station where children can freely choose the pre-loaded developmentally appropriate apps on her iPads.

**Technological Pedagogical Content Knowledge (TPACK)**

Technological Pedagogical Content Knowledge refers to knowledge about the complex relations among technology, pedagogy, and content that enable teachers to develop appropriate and context-specific teaching strategies.

Evidence of this was provided in the follow-up interviews. When talking about the Educreations app, Kristina commented,

““At group time, like today, we’re talking about hot foods. We were doing I’m going on a bear hunt [children’s song]. [We talked about] why they had to go on a walk. What foods do we eat that are okay to eat hot and we can we eat cold? So we made a chart of that [using Educreations]. And even when we use for transition, for excusing the children to put on their slippers, [we use Educreations]. If your name starts with this letter, so I use the whiteboard [in Educreations], and we wait for their name to come on.”

She also commented on how developmentally appropriate one particular app can be in the following statement in which she identifies areas in which she has a new perspective.

““And I was worried about the fine motor coordination, because they’re not---you know, but some of the apps like the puzzle apps, they have to maneuver, just one finger, but it’s eye hand coordination, maneuvering it to fit in that piece, and if they miss it, then that piece goes back to the original spot and they have to try again. So it’s like fine motor, but it’s also patience and perseverance.”"
In addition, she mentioned how she was able to incorporate social skills as indicated in the following statement.

“They’re pretty good about taking turns, and if they’re doing like the puzzle one or the concentration, after they pick two and it doesn’t match, or matches, it’s the next person’s turn so they’re going back and forth. And with the puzzles, it’s one piece and the next person goes next, so they’re pretty good about, I guess they know if they cannot take turns, they’re gonna have to find something else to do.”

She expressed variety of different ways she used iPads to enhance teaching and learning in the following statement.

“I think using the iPad in the discussions and bringing--like when we were planting wheatgrass, you know so they can see the wheatgrass from the time lapse, just bringing that world to them, and it’s like we’re talking about the ocean one and what kind of beach do they like to play in. So a clean one? So I had a picture of a nice clean beach with white sand and the water, and another with a lot of litter and the water was brown, which one do they want, and it’s for the sea animals too. Which is better for them?...but using, teaching them how to keep the beaches safe for us and the sea animals, and using the iPad to show and demonstrate that.”

Nina provided following statement when asked about how she used iPad with pedagogical and content considerations.

“Also, I actually took it home a lot and used it on my son and so we did a lot of, I tried a lot of the apps on my son, and then tried it in the classroom. I wanted to make sure that it was age appropriate, and it was something that would be engaging for them, because sometimes the apps are like just an intro and then that’s it and then it repeats itself, so I wanted to make sure it was appropriate [for age and content] cause he’s the same age as the class I had.”

Affective and TPACK Relationship

In examining the relationship between affective taxonomy and TPACK, additional themes emerged. First, both affective taxonomy from AV to AC and teachers’ technological knowledge from TK towards TPACK gradually increased over time. The
The following tables provide the frequency of affective and TPACK codings by data type. These tables included two data types, surveys and interviews.

**Table 14. Frequency of Affective Coding by Data Type**

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Date Collected</th>
<th>Affective-Value (AV)</th>
<th>Affective - Organization (AO)</th>
<th>Affective - Characterization (AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-survey</td>
<td>January 2013</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Post-survey</td>
<td>April 2013</td>
<td>4</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Group interview</td>
<td>May 2013</td>
<td>9</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Follow-up interviews</td>
<td>May 2014</td>
<td>0</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>

**Table 15. Frequency of TPACK Coding by Data Type**

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Date Collected</th>
<th>TPACK - TK</th>
<th>TPACK - TCK</th>
<th>TPACK - TPK</th>
<th>TPACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-survey</td>
<td>January 2013</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Post-survey</td>
<td>April 2013</td>
<td>7</td>
<td>1</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Group interview</td>
<td>May 2013</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Follow-up interviews</td>
<td>May 2014</td>
<td>16</td>
<td>5</td>
<td>8</td>
<td>23</td>
</tr>
</tbody>
</table>

According to the frequency of affective codings by surveys and interviews over time, a tendency for affective taxonomy level moved from simply valuing to more internalized organization and characterization by value (Krathwohl et al., 1964). Likewise, TPACK codings increased in number over time. Although this trend may be due to the fact that the focus of the follow-up interviews was TPACK, this trend is clearly indicated in Figure 15 below.
Figure 15. Change in frequency of Affective and TPACK codings by data type

This graph provides a clear visual of the progression of teachers’ change from AV to AC and TK to TPACK but it does not show how they relate to each other. However, the following comments from teachers suggest that the change in affective taxonomy fostered increases in teachers’ technological knowledge and their increase in technological knowledge fostered change in their attitude, confidence, and beliefs.

Jennifer: “I love it! I was really hesitant because, I wasn’t experienced with it. For me, I said, this is the children’s world and I said, I want to keep up with it. And I said, there’s someone I used to work with and she’d say I can’t remember – I can’t be bothered, I can’t be bothered, and I said I didn’t want to be like that. I said, we have to keep up with what the children are learning, this is their world. They don’t know anything, they don’t know what it’s like without computers and iPads, a lot of them, they have their own. And for the GOLD, it’s made it so much easier, and I was confident enough to use it at conference time, I had to show some of the parents what their children were doing, and I make a photo album for them, but it’s different to see it.”

Nina: “I guess in the past, my only form of technology was like a fake camera or a keyboard, or we never had computers in the classroom, working computers, yeah. Everything was generic, or fake, or broken, so it was nice to actually see
how well the iPad is so simple, and its mobile, and so to have it in the classroom, I’m like YES! I can say I’ve successfully used technology in the classroom!”

Kristina: “One morning a child came up to me and then the mother was dropping him off, and she was saying, ‘JR, ask Mrs. Kristina what you wanted to know!’ So I said, okay JR, what do you want to know? And he goes, ‘Do rhinoceroses have tails?’ And I guess he asked the mom the night before bedtime and she said she wasn’t too sure. So I said, ‘Okay, you know what? I don’t know. Let’s go take out the iPad.’ So I opened Google Image and we’re flipping through it. And I said. ‘JR, what do you think? Do you think they have tails?’ Cause I wanted him to find it himself, so he pointed to a rhinoceros, ‘Oh! That’s right! They do have tails!’

Hannah: “Yeah I think I did, anytime anything new, you have fear for almost anything new. And here was the iPad, I had to get used to it, so I was a little fearful of that and what I was able to play with and I think being able to have an iPhone and an iPad really helps because I can just multitask. You know now, I find that if something even happens, and especially now teaching it, it’s kind of like I’ve gotten into it, it’s kind of like, oh you want that? Let me find it real fast and I can find it really fast. Before I wasn’t able to find it. Whatever it is, if it’s a song or a video or something. It’s like I’ll find it, or she’ll say, “Oh I found this one, but I can’t get on.” Oh! I’ll find it! I think in the beginning it was a lot of fear to where now I feel pretty confident and pretty comfortable with it.”

Jennifer and Kristina, who considered themselves novices, increased their technological knowledge while at the same time moved affective taxonomy levels from valuing to characterization by a value complex. As their attitude, confidence, and beliefs changed about technology, they gained more technological skills and knowledge and as they gained more technological skills and knowledge, they changed their attitude, confidence, and beliefs about technology. Some of the change in attitude, confidence, and beliefs resulted from moving from closed-minded to open-minded, from perceptions that they were technologically incapable to capable, from beliefs that teachers should know everything to teachers who also continue to learn even from students, and from concepts of independent learning to peer learning and sharing.
Nina and Hannah, self-rated as intermediate level for their iPad skills and knowledge, increased to proficiency level towards the end of the project. Each also changed her affective taxonomy level from AV to AO. Their attitudes towards technology changed as they gained more confidence and they gained more confidence as they experimented with iPad in the classroom for assessing, teaching and learning. Hannah initially had confidence in her general technology skills but not specifically with the iPad for assessing, teaching, and learning. This idea is explored further in the next chapter.

Summary

This study provides three major findings in answering the two research questions. First, exploration in affordances of the iPad for the participating teachers resulted in common themes of efficiency and effectiveness in assessing, learning, and teaching. In addition, there were some affordances particular to learning and teaching. Second, exploration in how participating teachers progressed in discovering the affordances of the iPad indicated parallel progression in technological knowledge and change in their value system about the affordances of the iPad. Third, exploration in the progression of technological knowledge and change in their value system about the affordances of the iPad within the TPACK framework insinuated that there was a close relationship between the progression of TK towards TPACK and progression of AV towards AC.

Chapter 5 provides further discussions on the findings and limitations to this study. Next chapter also indicates implications and conclusions of the study and finally, discusses suggestions for future research.
CHAPTER 5. DISCUSSION AND CONCLUSIONS

The research questions addressed in this study were “What were the affordances that the iPads offered early childhood educators in assessing, teaching, and learning?” and “How did these affordances transpire within TPACK framework for early childhood educators?” This study provided three major findings in answering the two research questions. First, exploration in affordances of the iPads for the participating teachers showed common themes of efficiency and effectiveness in assessing, teaching, and learning recognized by the teachers. In addition, there are some affordances particular to the unique contexts of teaching and learning in an early childhood setting. Second, exploration in how participating teachers discovered the affordances of iPad over time indicates parallel progression in technological knowledge and change in their value system about the affordances of the iPad. Third, exploration in the progression of technological knowledge and change in their value system about the affordances of the iPad within the TPACK framework indicates that there was a close relationship between progression of technological knowledge towards TPACK and progression of affective valuing towards affective characterization.

The first part of this chapter further discusses the findings and limitations to this study. Second section covers implications and conclusions of the study and finally, third section discusses suggestions for future research.

Discussion of Findings

Today, technology is a common tool that is essential to how we function as a member of society. The ubiquity inevitably has spread to even the youngest members of our society, our keiki in Hawaiian. However, there is still much debate over how technology or digital media can foster the development of children in early educational settings. Recent developments in technology have changed basic accessibility, portability, and usefulness of digital devices as a powerful learning tool. Despite the continuing national debate about young children using digital technologies, multiple authors have
forwarded the proposition of the positive potential of mobile devices. Verenikina and Kervin (2011) report that iPads can serve as a vehicle to facilitate early education environments. DeCurtis and Ferrer (2011) discuss how the use of tablets or the iPad fit well within Piaget’s first two stages of cognitive development, the sensorimotor stage (birth to age 2) and preoperational stage (ages 2 to 7). Tablets, especially applications or apps on a device like the iPad, help children learn through their senses, gross and fine motor skills, learn to use symbols for objects, and think beyond the immediate present.

On the other side of the debate, there are valid arguments that such emphasis on digital media can result in negative outcomes for young children (Healy, 2005; Vandewater et al., 2007). But perhaps more important than the argument for positive or negative outcomes is recognizing the fact that digital media is part of very young children’s lives today, resulting in an urgency to better understand the developmentally appropriate use of digital media in the lives of young children (NAEYC & Fred Rogers Center for Early Learning and Children’s Media, 2012). In order to pursue better understanding of developmentally appropriate use of digital media in the lives of young children, important areas for study are understanding teacher preparation and support through professional development as well as educating families regarding this topic (Barron et al., 2011; Bittman et al., 2011; Clements & Sarama, 2002; McManis & Gunnewig, 2012; NAEYC & Fred Rogers Center for Early Learning and Children’s Media, 2012).

This study was one step towards understanding how early childhood educators use technology, which in this case happens to be iPads, and how to support early childhood educators to increase their technological knowledge but also integrate technological knowledge to provide developmentally appropriate learning environments. The findings were reflected back to current literature in technology in the early childhood education, how the characteristics and nature of the field influence technology integration especially in relation to the affective domain for learning.

**Overview of Major Themes**

The first research question led to an abundance of discoveries as early childhood educators explored affordances of the iPad. The major themes emerged in answering first
research question were efficiency and effectiveness in assessing, teaching, and learning. Particular to learning affordance, the ubiquity of technology was very much present in the preschool children as indicated in the literature review (Gutnick et al., 2011). Teachers reported that the children were already skilled in using the iPad and there were incidences when the teachers were learning from the children. In addition, peer learning occurred among children and teachers when using the iPads. Particular to affordances for teaching, there were challenges related to policy and management that were also mentioned in current literature (Hutinger et al., 1994).

In answering the second research question, the findings aligned with the current research. As indicated in current literature (Beach & Stefanick, 2010; Hutinger et al., 1994; Kelley et al., 2003), the early childhood educators were initially apprehensive about integrating technology in the classrooms mainly because of conflicting ideas about appropriate use with young children. However, as indicated by multiple studies (Rivera et al., 2002; Wardle, 2000), the teachers’ attitudes and beliefs in technology impacting student learning affected their willingness to explore and gain technological knowledge. In addition, the affective dimension was influential for early childhood educators (Kretchmar, 2014; Pierre & Oughton, 2007; Saluja et al., 2002; Shephard, 2008) in making the shift not only in their attitudes and beliefs but also in increasing their technological knowledge as it pertains to pedagogical and content knowledge.

**Efficiency and Effectiveness in Assessing, Teaching, and Learning**

The common themes among the various affordances that the iPads offered early childhood educators manifested in possible efficient and effective opportunities to assess, learn, and teach. Although the focus of the grant project was mainly to use the iPad for assessment, the multi-functional nature of the tool made it possible for teachers to explore other uses, particularly in terms of classroom teaching as well as learning tasks. Having the iPads in the classroom excited both teachers and children and the teachers noted these not only allowed for the introduction of novel content but also proved to be motivating and engaging for the children. Even with only four teachers, there were highly diverse ways of applying the iPads to teaching. Not only was this affected by teaching styles and
technology confidence, but also by the composition of students in any given classroom, including age, learning, and class size differences.

The findings indicated that teachers were able to use technology efficiently and effectively in their assessment process. Specifically, the teachers indicated that the iPad allowed more rapid data entry, increased the information that could be documented, and were particularly interested with the new kinds of multimedia examples that could be added to the portfolios. They also indicated that they had developed skill in using the mobile GOLD® app for assessment, and had greater confidence in their assessment capabilities. The importance of experimentation and sharing with other teachers was a primary way of learning about the assessment app, and was enhanced by the project’s workshop structure that encouraged community development and teacher input.

As teachers became more familiar with the iPad capabilities, this device began to replace other more traditional tools like projectors and CD players. The iPads allow for storage as well as instant access to huge libraries of images, sound, and video that make it easy to call up resources on demand. While teachers usually had prepared materials in advance to use in their classrooms for a given curricular topic, most demonstrated a spontaneity that supported “just-in-time” teaching as questions arose from students. The anytime-anyplace access to a wealth of information and resources of a mobile device was highly valued.

The diagram in Figure 16 provides a visual representation of the findings.

![Figure 16. iPad affordances within the context of early childhood education (ECE)]
There is still so much to discover about the affordances of the iPads in the early childhood setting. This study opened up a lot of possibilities in how it can be used in efficient and effective ways to assess, teach, and learn.

**Technological Knowledge and Change in Value System**

The participants of this single-case study included early child educators with varying technological knowledge (TK). TK included iPad skills and knowledge as well as general computer skills and knowledge. Initial survey indicated that all had previous personal experience with mobile devices and two had previously used an iPad although neither considered to be proficient with this technology.

In post-survey, teachers self-rated an increase in technology skill and confidence over those indicated in the initial survey. The most novice and least confident of the four indicated improvement but was still tentative in her abilities. Those who experimented with personal uses in addition to classroom uses had greater learning gains.

Following diagram in Figure 17 provides a visual look at relationship between progression in TK to TPACK and AV to AC.

*Figure 17. Affective and TPACK Relationship*

Overall, teachers gained not only skills and knowledge in mobile technology but also gained confidence and openness towards technology use for learning, new insights
into more efficient use of technology in assessment, and possible distinctions between age appropriate uses of mobile technology for young children. Perhaps the most powerful evidence was obtained from Jennifer and Kristina who indicated that they were novices in the iPad and technology skills in the beginning of the study but gained enough confidence to volunteer to present at an early childhood conference. All four teachers also indicated they were excited to continue to learn and explore new uses of iPads and to complete assessments successfully with the new tools they had mastered.

The participating teachers not only improved skills but also changed attitudes and beliefs about what was possible in using technology with young children. The findings showed that there were intricate relationships between their change in attitudes and beliefs with increased technological skill integrated with their pedagogical and content knowledge.

**Attitudes and Beliefs Matter**

The relationship between progression in affective taxonomy and TPACK supported that attitudes and beliefs mattered in not only gaining technological knowledge but also teachers moving from having TK towards TPACK. In Chapter 4, when looking at the frequency of coding in TK to TPACK and AV to AC, they both increased over time but when examining data more closely, it revealed that the progression from AV to AC was a necessary component to making TK to TPACK and vice versa.

Krathwohl et al. (1964) suggest “if cognitive objectives are developed, there will be a corresponding development of appropriate affective behaviors” (p. 20). Rokeach (1960) also agrees with Krathwohl et al. (1964) indicating “every cognitive behavior has its affective counterpart” (p. 399). Scheerer (Scheerer, 1954) goes one step further to indicate “cognitive-emotional-motivational matrix” (p. 123) cannot be separated from one another. Most of the research in education focuses on cognitive domain but there is a need to investigate cognitive objectives as a means to affective goals (Asch, 1952; Festinger, 1957; Heider, 1958; Rhine, 1958; Rosenberg, 1956) as well as affective objectives as means to cognitive goals (Bruner, 1960; Festinger & Carlsmith, 1959; Jahoda, 1956; Kelman, 1958; White, 1959).
This study, however, found that achievement of cognitive and affective goals happen simultaneously similar to what Suchman (Suchman, 1962) suggested. The affective goal, in this case the varying affective taxonomy levels (AV, AO, AC) pushed the cognitive goals, in this case technological knowledge (TK, TCK, TPK, TPACK) but technological knowledge also influenced their affective knowledge.

Some of the open-ended questions dealt with how they felt they learned to use their iPads, and the role that the professional development (PD) played in that learning. There were distinct differences in learning styles among teachers: one preferred to research herself but another teacher, the most novice, preferred specific lessons and instructions. All appreciated opportunities for discussion during the workshops with the other teachers and wanted more of this as a focus of professional development. In general, they said the PD opportunities were too short and not enough. They also noted that one advantage to the grant was the chance to get together to talk about the iPad uses and that this would be hard to do without release time. When asked about continuing issues, three indicated concerns about the fragility of the iPads when used in the classroom, commenting on fears about protection of the devices physically. General issue comment was not having enough time to learn everything they want to learn.

The teachers learned best when given the opportunity to share with each other and explore independently. However, for the most novice user more formal "how to" instruction was needed as well. Time was important for learning, particularly release time for talking and professional development.

**Implications and Conclusions**

This study adds additional insights to previous studies of TPACK framework. The contribution this study makes to previous studies is adding another layer to the study of TPACK framework in the context of early childhood education. The use of mobile technology in educational setting has not even reached a decade but the rapid spread of use in both informal and formal educational setting is astounding. Wu et al. (2012) reviewed trends from mobile learning studies from 2003 to 2010 by analyzing 164 carefully selected publications. Figure 18 provides distribution of mobile learning studies by research purpose and it indicates small percentage addressing the affective domain
during mobile learning and learner characteristics in the mobile learning process. This study investigated the obvious shortage in research which addressed the characteristics of early childhood educators and how affective domain factors into their technological skills and knowledge construct.

![Distribution of mobile learning studies by research purpose](image)

**Figure 18. “Distribution of mobile learning studies by research purpose”**  
(Wu et al., 2012, p. 820)

In addition, there are less case studies on mobile learning compared to surveys or experimental research methods. Figure 19 provides a summary of classification of mobile learning studies by methodology.

![Classification of mobile learning studies by methodology](image)

**Figure 19. “Classification of mobile learning studies by methodology”**  
(Wu et al., 2012, p. 821)
**Affordances of the iPads**

The affordance theory provides some insight into how perception of affordances translates into actual use (Greeno, 1994; Sadler & Given, 2007). It is quite interesting that the participating teachers found various affordances without any instructions from the investigators. An implication of this study has so many research potentials. Further research can be conducted in the area of effective and efficient use of mobile technology for educational purposes and additional finding in the subcategory of learning can span out to a research of its own. Some literature (Healy, 2005; Vandewater et al., 2007) questions the role of mobile technology in social development of young children but in this study, there was potential for social skills to be fostered if teachers actually employed technological pedagogical and content knowledge (TPACK). There are other implications in affordances for teaching which related to management of the mobile devices and how policy and administration impacts developmentally appropriate technology integration. These are areas that can be further researched for best practices as technology integration becomes more prevalent even in the preschool classrooms.

**“A” for Affective Knowledge in TPACK**

The findings of this exploratory case study on how technology integration occurred within the TPACK framework revealed that affective knowledge was a key component in moving teachers toward integration of technological knowledge with content and pedagogical knowledge. Thus, this study suggests modifying the framework to include affective knowledge for TPACK framework. Mishra and Koehler (2008) explained that “A” in TPACK was added simply to make the acronym easier to pronounce by adding a vowel. However, this study suggests that “A” in TPACK should stand for affective knowledge. The diagram in Figure 20 represents how the new TPACK framework within the context of early childhood education would look.
Figure 20. Technological Pedagogical Affective and Content Knowledge (TPACK)

The expansion of additional affective knowledge to the TPACK framework now provides four foundation knowledge components and eight components now within the framework that “address how these bodies of knowledge interact, constrain, and afford each other” as defined by Mishra and Koehler (2008). This revised framework needs future studies in terms of how this knowledge will integrate but there are critical implications to future practice for in-service professional development or pre-service teacher training in the field of early childhood education.

**Recommendations for Future Studies**

This study only covered a fraction of what is needed to further studies on investigating TPACK in the context of early childhood education. As indicated in chapter 2, currently only one study on TPACK was conducted within the context of early childhood educators so any research within this context will promote better understanding of how TPACK framework can be used. The findings regarding “Affective Knowledge” being an important one for early childhood educators when looking from a TPACK framework can be also true in other educational contexts. It will be interesting to see if affective knowledge is an important factor as indicated in this study when examining TPACK framework beyond early childhood educators.
Based on this study, it is recommended that pre- and in-service teacher training professionals consider affective knowledge when integrating TPACK framework. Although this case study covered participants of wide range of technological knowledge, further research is necessary to include larger sample groups of early childhood educators to confirm the findings. In addition, future studies can look beyond the early childhood context and consider elementary and secondary teachers to see if the findings also apply.

Further studies on shaping the instrument needed to measure the affective knowledge will help when researching with a larger sample population.

**Summary**

This exploratory single-case study answered two research questions by using coding methods of data analysis in two cycles. The data used for this analysis includes existing data from a grant project completed at the end of 2013 and new data from follow-up interviews collected in May 2014.

The proposition of this study that the affective domain for learning would play an important role in exploring how early childhood educators work toward integrating technological pedagogical content knowledge (TPACK) in order to provide developmentally appropriate integration of technology in the early learning environment was thoroughly examined. The evidence provided that the affective domain indeed was an important and critical factor in moving towards TPACK for the early childhood educators.

The findings in this study may possibly lead to other future studies in this area to explore the TPACK framework within the context of early childhood education and also further examine if affective knowledge might be an important factor in TPACK within other contexts than early childhood education.
February 19, 2013

Ms. Elizabeth Park
Director, Early Childhood Education
Chaminade University
3140 Waialae Avenue
Honolulu, Hawaii 96816

Dear Director Park,

On behalf of the Chaminade University of Honolulu IRB Committee, this letter is to acknowledge approval of your Institutional Review Board application for iTEACH (iPad for Teacher’s Educational use At Children’s Habitat). If there are any substantial changes to the research plan, please inform me immediately so that the IRB Committee can review the changes.

Should you have any questions or concerns, I can be reached through email at the joseph.peters@chaminade.edu address or by phone at 808-735-4844.

Respectfully submitted,

Joseph Peters
Dean of Education
Consent to Participate in Research

Title of Research: iTEACH (iPad for Teacher’s Educational use At Children’s Habitat)

Introduction: iTEACH grant is funded by Samuel N. and Mary Castle Foundation. The researchers are Elizabeth Park, Dr. Ellen Hoffman, Dr. Grace Lin, and Dr. Michael Robb. Federal regulations require us to obtain signed consent for participation in research involving human participants.

Thank you for your interest in this research project being conducted at KCAA Preschools of Hawai’i in collaboration with Chaminade University of Honolulu, University of Hawai’i, and Fred Rogers Center for Early Learning Environment. You will find a summary of the major aspects of the study described below, including the risks and benefits of participating. Carefully read the information provided below. If you wish to participate in this study, sign your name and write the date. Any information you provide to us will be kept in strict confidence.

Activities and Time Commitment: This project is to better understand best practices and effective use of iPads for teachers in early childhood educational environment. This project is scheduled from February 2013 to August 2013 and during this time, you will be asked to participate in surveys, focus groups or individual interviews, workshops, and observations. Time commitment estimated for this project is 30-40 hours over the period indicated above. The focus group or individual interviews may be recorded so it can be transcribed and analyzed later. You will be one of four teachers participating in this project.

Benefits and Risks: This grant included substitution costs if you are required to participate outside of the classroom and some gifts cards will be provided to compensate for your time. Although there will be no direct payment for the participation, we hope that you will not only contribute to the much needed knowledge in this area but also gain personal knowledge and skills that you can apply in your classroom. There is minimal risk for you in participating in this research project. If however, you become stressed or uncomfortable answering any of the questions, you may choose to skip the question, or take a break, or withdraw from the focus group or interview. We do not expect any questions that will require information other than your professional knowledge and experience as an early childhood educator.

Privacy and Confidentiality: During this research project, we will keep all data in a secure location. Only the researchers and the grant participants will have access to the data, although legally authorized agencies, including the Committee on Human Studies, can review research records. After we transcribe the interviews, we will erase/destroy the recordings. All the identifiable material will be kept secure until destroyed. When the results are reported, we will not use your name or any other personally identifying information.

Voluntary Participation: Your participation in this project is completely voluntary. You may stop participating at any time without any penalty or loss. Your participation or non-participation will not
impact your rights to future services at KCAA Preschools of Hawai‘i. As compensation for time spent participating in the research project, you will receive gift card of small amount.

If you have any questions about this research project, please call Elizabeth Park at 808-295-1390 or email at epark@chaminade.edu. If you have any questions regarding your rights as a research participant, please contact Dr. Joe Peters at Chaminade University of Honolulu Institutional Review Board at 808-735-4844 or joseph.peters@chaminade.edu.

I have read and understand the information provided to me about participating in the research project. My signature below indicates that I agree to participate in this research project.

Printed name: ____________________________

Signature: ________________________________

Date: ________________________________

You will be given a copy of this consent form for your records.
April 25, 2014

TO: Elizabeth Park  
Principal Investigator  
College of Education - Educational Technology

FROM: Denise A. Lin-DeShetler, MPH, MA  
Director

SUBJECT: CHS #22099- “iTEACH: iPad for Teachers' Educational use at Children's Habitat”

This letter is your record of the Human Studies Program approval of this study as exempt.

On April 25, 2014, the University of Hawai‘i (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45CFR 46.101(b)(Exempt Category 4).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at http://www.hawaii.edu/jrb/html/manual/appendices/A/belmont.html.

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.
Approval of Exempt Study Modification

Re: Exempt Study Modification – 22099

Human Studies Program <uhirb@hawaii.edu>
Tue, May 13, 2014 at 9:57 AM
To: Elizabeth Park <epark@chaminade.edu>
Cc: Ellen Hoffman <hoffman@hawaii.edu>

Elizabeth Park,

The request for changes on your exempt project noted above has been reviewed and approved. The proposed amendments will be added into your current project file. The proposed changes do not alter the exempt status of your project still in effect.

Thank you for keeping us informed about the progress of this study.

Jacob Kowalski
Human Studies Program
UH Office of Research Compliance
University of Hawai'i

Consent to Participate in Research Project:
A Case Study Exploring TPACK Framework within the Context of Early Childhood Education

My name is Elizabeth Park and I am a Ph.D. student at the University of Hawai‘i at Manoa (UH), in the Department of Educational Technology. I am conducting this research as part of my dissertation. The purpose of this exploratory case study is to investigate the affordances of iPad and how these affordances transpire technological integration within the TPACK (technological pedagogical and content knowledge) framework by early childhood educators. I am asking you to participate in this project because you were part of the iTEACH project using iPad for assessing, teaching, and learning.

What activities will you do in the study and how long will the activities last? If you participate, I will interview you once in person. The interview will last for about 25 to 30 minutes. I will record the interview using a digital audio-recorder. I am recording the interview so I can later type a written record of what we talked about during the interview. I will evaluate the information from the interview. If you participate, you will be one of a total of four teachers who I will interview individually. One example of the type of question I will ask is, “What are some ways you use iPad for assessing, teaching, and learning?” If you would like to see a copy of all of the questions that I will ask you, please let me know now.

Benefits and Risks: There may be no direct benefits to you in participating in my research project. The results of this project might help me and other researchers learn more about how to integrate technology for early childhood educators. I believe there is little or no risk to you in participating in this project. There is a possibility you may become uncomfortable or stressed by answering an interview question or questions. If that happens, we will skip the question, or take a break, or stop the interview. You may also withdraw from the project altogether.

Confidentiality and Privacy: I will keep all information from the interviews in a safe place. Only I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawaii Human Studies Program has the right to review research records for this study.

After I write down the interviews, I will destroy the audio-recordings. When I report the results of my research project in my typed papers, I will not use your name or any other personal information that would identify you. Instead, I will use a pseudonym (fake name) for your name. If you would like a copy of my final report, please contact me at the number listed near the end of this consent form.
**Voluntary Participation:** Participation in this research project is voluntary. You are free to choose to participate or not to participate in this project. At any point during this project, you can withdraw your permission without any loss of benefits.

**Questions:** If you have any questions about this project, please contact me at via phone (808) 295-1390 or e-mail (ekpark@hawaii.edu).

If you have any questions about your rights in this project, you can contact the University of Hawaii, Human Studies Program, by phone at (808) 956-5007 or by e-mail at uhirb@hawaii.edu.

Please keep the section above for your records.
If you agree to participate in this project, please sign the following signature portion of this consent form and return it to Elizabeth Park.

---

Tear or cut here

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**Signature(s) for Consent:**

I agree to join in the research project entitled, *A Case Study Exploring TPACK Framework within the Context of Early Childhood Education.*” I understand that I can change my mind about being in this project, at any time, by notifying the researcher.

**Your Name (Print):** _____________________________________________

**Your Signature:** _____________________________________________

**Date:** _______________________________
APPENDIX 2. PRE-SURVEY

Please note that the Pre-Survey Instrument was developed by Dr. Ellen Hoffman in collaboration with Dr. Grace Lin and myself.

Getting to Know You Survey for iTACh

As we work together on the iTACh project, it will help if you tell us a bit about yourself so we know how we might be helpful.

The survey has a few demographic questions and brief questions about your technology skills. There are also several open-ended questions – write as little or as much as you would like us to know. Please answer them in terms of your professional experience and knowledge as an early childhood educator.

All questions are optional so you may skip any that you prefer not to answer.

Mahalo for your help in completing the survey.

Name - please include your first and last name

Age - what YEAR were you born?

What is the highest level of education you completed?
- High school
- Associate's degree
- Bachelor's degree
- Some graduate school but no degree
- Master's degree
- Doctorate
- Other: [ ]

What is the highest level of education you completed in Early Childhood Education?
- High school
- Associate's degree
- Bachelor's degree
- Some graduate school but no degree
- Master's degree
- Doctorate
- None
- Other: [ ]

How many years have you worked as an early childhood educator?

How many years have you worked in pre-kindergarten education?
What concerns do you have about using an iPad?

What do you think are the most important issues in using technology in early childhood education?

How do you think an iPad will be helpful in your assessment tasks?

Are there any technology skills or uses you would particularly hope we would help you with in this project?

Have you ever visited the Fred Rogers Center Early Learning Environment (Ele) website?

☐ Yes
Is there anything else you think you would like to tell us or think we should know as we start the iTEACH project?
What is your ethnic background?

What languages do you speak other than English?

At what level would you rate yourself in terms of using computers?
- Novice
- Intermediate
- Proficient
- Expert

Which of the following have you used?
- iPod
- MP3 player (not iPod)
- Smartphone (iPhone)
- Smartphone (Android)
- Smartphone (other)
- Videogame console (Wii, Playstation, xBox)
- iPad
- Tablet computer (i.e., Kindle Fire, Samsung Galaxy, Nexus)
- eBook reader (Kindle, Nook)

In general, learning new technologies is...
- Very easy for me
- Somewhat easy for me
- Average
- Somewhat challenging for me
- Very challenging for me

What level would you rate yourself in terms of using an iPad?
- Novice
- Intermediate
- Proficient
- Expert

How long have you been using an iPad (you can indicate zero if you are just beginning)

What is most exciting about using an iPad?
APPENDIX 3. POST-SURVEY

Please note that Dr. Ellen Hoffman developed the Post-Survey instrument in collaboration with Dr. Grace Lin and myself.

### iTEACH Survey - June 2013

Thank you so much for being a part of the iTEACH Project. We are now at the stage where we need to collect data about how the project went: what worked and what we could improve. This will also help as we seek new funds to build on this project and perhaps continue some support that you would like to have in place.

The survey has five sections:
- I. Proficiency
- II. Assessment
- III. Fred Rogers Center "Early Learning Environment" (Ele) website
- IV. Other iPad Uses
- V. Project Evaluation

It may look long but a number of the questions are quick select one number on a scale. On open-ended questions, write as much or as little as you wish. You are not required to answer all questions although we appreciate your help on each of them.

Thanks for your patience. Your answers are very important to us. If you have questions or a problem, you can email Elizabeth Park (epark@chaminade.edu) or Ellen Hoffman (ellenhoff@gmail.com) for help.

### I. Proficiency

1. At what level would you rate yourself in using computers in general?
   - Novice
   - Intermediate
   - Proficient
   - Expert

2. I am confident in using technology and digital media to plan to do activities with young children.

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<tbody>
<tr>
<td>Stronlgy agree</td>
<td>Strongly disagree</td>
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3. I am confident in using technology and digital media to teach digital literacy concepts to young children.

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<tbody>
<tr>
<td>Strongly agree</td>
<td>Strongly disagree</td>
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4. I am confident in using technology and digital media to interact with other professionals.

   | 1 | 2 | 3 | 4 | 5 |
5. I am confident in using technology and digital media to interact with parents.

1 2 3 4 5

6. At what level would you rate yourself in using the iPad?

- Novice
- Intermediate
- Proficient
- Expert

7. Since this project started, I have increased my SKILLS in using an iPad in general:

1 2 3 4

Significantly increased my skills ○ ○ ○ ○ No increase in my skills

8. Since this project started, I have increased my CONFIDENCE in using an iPad in general:

1 2 3 4

Significantly increased my confidence ○ ○ ○ ○ No increase in confidence

9. Overall, I find the iPad easy to use.

1 2 3 4 5

Strongly agree ○ ○ ○ ○ Strongly disagree

10. In general, what are the ways you most prefer to learn about using your iPad?

II. Assessment

This begins the section on "Assessment and the GOLD App"
11. Since this project started, I have increased my ability to use an iPad for assessment.  
This begins the section on “Assessment and the GOLD App”

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

12. I am able to use the iPad GOLD App with proficiency.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

13. How has an iPad been helpful in your assessment tasks?


14. In what ways has the iPad Gold app made your job easier?


15. Are there any limitations in the Gold app that you think should be improved?


16. What advice would you give to other pre-school teachers who are just starting to use the iPad Gold app?


III. Fred Rogers Center "Early Learning Environment" (Ele) Website

17. How often have you visited the Fred Rogers Center "Early Learning Environment" (Ele) website?
   - Daily
   - Several times a week
   - About once a week
   - A few times
   - Rarely since the Ele workshop session

18. I have found the Ele site useful for helping me in my job as an early childhood educator.
   
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<th>4</th>
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<tbody>
<tr>
<td>Very useful</td>
<td></td>
<td></td>
<td>Not useful</td>
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19. I have found the Ele site useful for finding resources for my class.
   
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<th>4</th>
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<tr>
<td>Very useful</td>
<td></td>
<td></td>
<td>Not useful</td>
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20. I have used the Ele site to share my ideas with others.

   - Often
   - Occasionally
   - Never

21. What are the three most useful parts of Ele for you?

22. What are issues that keep you from using Ele more often?

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23. Do you have any recommendations for improving the Ele workshop you attended that might make it better in the future for early childhood educators?

IV. Other iPad Uses

This begins the section on "Other iPad Uses"

24. How often do you download and test new iPad apps that you think may be used WITH the children in your classroom?

1  2  3  4

Frequently ☐ ☐ ☐ ☐ Not at all

25. What are important things to consider when you are evaluating an iPad app to use in your classroom with your students?

26. How often do you download and test new apps that help you with teacher-related tasks (planning, keeping track of things like attendance or resources, assessment, meetings, communications with others)?

1  2  3  4

Frequently ☐ ☐ ☐ ☐ Not at all

27. About how many apps do you now have on your iPad?

28. What apps have you wanted but could not get because they were not free to download, if any?
29. What three iPad apps would you recommend to other pre-school teachers and why?

30. How often do you show your students Internet resources using your iPad (web sites, images, online music or videos, etc.)?

1 2 3 4
Frequently ○ ○ ○ ○ Not at all

31. How often do you show your students multimedia or other resources stored on your iPad (music from your own music library, images from your own photo collection, videos, etc.)?

1 2 3 4
Frequently ○ ○ ○ ○ Not at all

32. How often do you use the iPad for taking pictures in your classroom (including of students and student work)?

1 2 3 4
Frequently ○ ○ ○ ○ Not at all

33. How often do you use the iPad to record video or audio of your class?

1 2 3 4
Frequently ○ ○ ○ ○ Not at all

34. How often do you share images or recordings from your class with students’ parents/caregivers?

1 2 3 4
35. Are there examples of other ways the iPad has helped you communicate with parents/caregivers?

36. How often do you use an iPad in meeting your personal, non-teaching goals?
   1  2  3  4

37. What do you consider the most important change in your teaching that you have been able to do because you have an iPad?

38. Are there any things you have wanted to do with your iPad that you haven’t been able to do or get to work? Please give examples.

39. What are the constraints, if any, in using the iPad in your classroom?
V. Project Evaluation

The remaining questions are evaluations of the iTEACH Project.

40. This project has helped me improve my technical skills.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

41. This project has expanded my ability to use technology for assessment tasks.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

42. This project has helped me see new ways to use technology in my classroom.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

43. This project has helped me locate new resources I can use as a teacher.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

44. The project meetings and workshops were appropriate for my needs.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

45. I am excited about using my iPad in my teaching in the future.

1 2 3 4 5

Strongly agree ☐ ☐ ☐ ☐ Strongly disagree

46. What is the most important learning you are taking away from the iPad project?
47. What would you recommend be changed if this project were being expanded to be done with more pre-school teachers?

48. Are there any additional feedback or comments you would like to add about the project?
APPENDIX 4. FOLLOW-UP SURVEY

Please note that Dr. Ellen Hoffman developed the Post-Survey instrument in collaboration with Dr. Grace Lin and myself.

iTEACH Follow-Up Questions

Please choose the most appropriate answer choice for the following statements.

1. This project has expanded my ability to use technology for assessment tasks.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

2. This project has helped me see new ways to use technology in my classroom.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

3. I am excited about using my iPad in my teaching in the future.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
4. I am using some of things I learned from the project as I prepare for teaching in a new semester.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

5. What kinds of things are you most interested in doing in the new school year with your iPad?

Never submit passwords through Google Forms.
APPENDIX 5. FOLLOW-UP INTERVIEW QUESTIONS

Follow-Up Interviews
Semi-Structured Guiding Questions:

**Affordances**
What are some ways you use iPad for assessing, teaching, and learning?

- Tell me what you use iPad for? I know you use it for GOLD but how else do you use it for?

**Affective**
Have your value towards using iPad or technology for assessing, teaching, and learning change? Why or why not?

- What do you value the most about using iPad or technology in general for assessing, teaching, and learning?

- What was the most valuable aspect of the first grant project that made you build more confidence in using iPad or technology?

- How did your idea on how iPad or technology can be integrated into the classroom changed after iTEACH project last year?

- What helped you to make the change in becoming more comfortable and valuing use of iPad or technology into the classroom?

- Has there been additional value added to what you used to do with your iPad or technology from last year?

**TPACK (Technology Pedagogy and Content Knowledge)**
Describe a specific situation where you effectively demonstrated developmentally appropriate use of content, technologies and teaching approaches in a classroom. Please include in your description what content you taught, what technology you used, and what teaching approach(es) you implemented.

**General**
Any other comments regarding iPad or technology use for assessing, teaching, and learning in the early childhood education?
REFERENCES


