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YOUNG CHILDREN'S PLAY USING DIGITAL TOUCH-SCREEN TABLETS

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Young Children's Play Using Digital Touch-Screen Tablets

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Dedication

For my family ~ I love you harder than a mule can kick a tree…

Acknowledgements

A search for the origins of the quote, “standing on the shoulders of giants” reveals a whole host of names to whom these words have been attributed. Likewise, my own assemblage of words in this document can be attributed to the assistance of a company of figures—the giants on whose shoulders I stand. First, I must thank my two co-chairs—Stuart Reifel and Nancy Roser. From the first, Stuart challenged me to push my thinking, question my assumptions, and always, to consider children as central to any inquiry on early childhood and the context of play. Likewise, Nancy helped me keep my focus on what is best for children and learning, and she inspired me to read deeply, speak thoughtfully, and write meticulously. I know I can never attain the height of scholarship and brilliance that these two scholars embody, but I always hold them up as my (collective) north star.

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YOUNG CHILDREN'S PLAY USING DIGITAL TOUCH-SCREEN TABLETS

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National early childhood organizations have posited that technology tools might be used to expand young children's thinking and experiences if offered in playful ways, and organized with interactive activities that allow for individualization and social interaction (NAEYC & Fred Rogers Center, 2012). Furthermore, these organizations have argued for the need to study newer technologies such as touch-screen technologies (NAEYC & Fred Rogers Center, 2012). The purpose of this study is to examine young children's technology-related play choices and actions particularly as they occurred with touch-screen tablets in a classroom setting. The 10-week qualitative study, organized around a classic grounded theory methodology (Glaser, 1978, 1992, 1998) and conducted within a single classroom, reports the close observation and description of 14 public-school pre-kindergarten students' actions with open-ended, symbolic-play tablet apps and interactions with one another, toward building a grounded theory of children's socially situated, tablet-centered digital play. The findings of this study demonstrate how participants' play choices were situated within multiple nested social spheres, including layers of digital play, the iPad activity-center, and the classroom as organized by the teacher. Examination of children's changeable play actions and choices revealed students' use of reflexive tracking as they actively navigated between personal and social

interests to engage in three types of play: sampling, experimenting, and engaging in pretense. The findings and theorized model of socially situated dual-tablet play inform the discourse on technology integration in early childhood classrooms as well as the discourse on play, particularly in regards to digital play.

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Chapter 1: Introduction

Statement of the Problem

Technology has increasingly become a prevalent part of many twenty-first century children's daily experiences (see Rideout, 2014; Rideout & Hamel, 2006), and education leaders and researchers have begun to take note. Two large early childhood focused organizations—the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center for Early Learning and Children's Media—have responded to the pervading influence of technology in children's lives by partnering to develop a position statement on the appropriate uses of technology with young children (NAEYC & Fred Rogers Center, 2012). The position statement contends that technology is a tool that can be used to expand children's understanding and experiences in ways that are developmentally appropriate, allow for individualization and social interaction, and fit within children's interests, sociocultural backgrounds, and their physical, cognitive, emotional, and linguistic development and abilities. The position statement provides recommendations (supported by emerging research as well as recommendations from other professional organizations) for how to integrate technology. This position statement especially focuses on the importance of including technologies that allow for children's interactive engagement. Furthermore, the authors recommend that the interactive engagement should be offered in a playful way (p. 7). NAEYC/FRC's joint position statement emphasizes that any technology-enhanced play should offer more options but should ***not*** replace existing options; it should provide "additional options for self expression" (p. 8).

One of the most recent developments in technological tools is the touch-screen tablet—a device that can be easily manipulated with simple touch and swipe gestures, even by young children. These devices have found their way into the hands of children in their out-of-school lives, and are taken up quickly by these young explorers. Recently, I observed a three-year-old friend (I will call him Sam) playing with a drawing application (app) on an iPad at home. Even though he was an experienced iPad player, this was the first time he had encountered this particular app. A brief summary of our interactions follows:

> Without saying a word, I tap open a paint palette and make a quick squiggle on the screen with my finger. He takes his index finger and begins to slide it back and forth across the screen, coloring a little spot. I make a few more marks with my finger and he continues to color over the same spot, moving his head forward to look closer, and then back again. I hold out a stylus and say, "Would you like a pen?" Sam wrinkles his brow a bit, looking at it. I make a few marks on the screen with the stylus top and then hold it out to him. Sam grabs it, briefly pushes the squishy tip with his thumb, and then quickly, bear-claw grasp, begins swiping the squishy tip across the iPad screen. Over the next ten minutes, Sam jabs, pokes, swirls, swipes, and taps the stylus on the screen, making a variety of marks, using a variety of grips, and occasionally stopping to watch his brother interact with an e-book. At one point, Sam even turns the stylus upside down and begins to examine the squishy part again, wrinkling his brow and pulling it closer to his face. He pushes the squishy tip with his thumb, looks to see if it made a mark there, then slides it back and forth again across his thumb. Again, he looks for a mark. He then rubs the soft part against his cheek before resuming his drawing, jabbing, swirling, and sliding colors across the screen. It reminds me of his earlier experimentation with watercolors that day.

This same Sam had earlier taken great delight in experimenting with watercolors—pouring paint into each little circle of color, swirling his brush through the paints, mixing the paints into the water cup, and jabbing and poking his brush over and around his paper. He swirled, jabbed, poked, swiped, and mixed paints and water until the paper tore, and I quickly gave him another piece.

As I reflected on Sam's exploration and play in each space, I considered the possible similarities and differences of his interests, choices, and creations displayed in the presence of the iPad application tools. He made certain choices while playing in each space—the physical space with real water, watercolors, paintbrush, paint, and the digital one with a screen, stylus, and colored light. I was familiar with such play in physical space, but curious about how he might explore and play in a digital space, particularly one afforded by this new interactive touch-screen tablet that seems so quickly taken up by even some of our youngest learners.

The research reviewed in the NAEYC/FRC (2012) position statement includes few studies of children's digital play experiences, though it does cite research on children's screen time (types, amount, age-level appropriateness, interactive/passive), technology access/equity, special-needs adaptive technology, and both cognitive and social development linked with technology tools. A wider search reveals a small but growing body of research on young children's technology-integrated play, including studies on children's computer software play in schools (Arnott, 2013; Brooker & Siraj-Blactchford 2002; Escobedo, 1992, 1999; Genishi, 1988, 1989; Genishi & Strand, 1990; Heft & Swaminathan, 2002; Labbo, 1996; Ljung-Djärf, 2008; Ljung-Djärf, Åberg-Bengtsson, & Ottosson, 2005; Wang & Ching, 2003); at home (Davidson, 2010; Verenikina, Herrington, Peterson, & Mantei, 2010); in online play (Marsh, 2010; Wohlwend, Vander Zanden, Huysbe, & Kuby, 2011); with literacy 2.0 play (Wohlwend, 2010); in symbolic play using computer games (Verenkikina, Herrington, Peterson, & Mantei, 2010), and with technology-based play in general (Takeuchi, 2012). Only recently, however, have studies researched/investigated interactive technology tools—touch-screen tablets (Lynch & Redpath, 2012; O'Mara & Laidlaw, 2011; Verenikina & Kervin, 2011). There are a limited but growing number of studies on young children's home play experiences with these devices (e.g., O'Mara & Laidlaw, 2011; Verenikina & Kervin, 2011) as well as children's technology-based play and exploration in schools (Lynch & Redpath, 2012). Emerging research on young children's play and processes with such devices in schools (Lynch & Redpath, 2012) include studies of children's touch-screen tablet experiences (iPads) for achieving specific curricular goals such as reading comprehension (Fadjo, Friedman, Black, & Johnson, 2012), literacy skill development (Hutchison, Beschorner, & Schmidt-Crawford, 2012), and mathematical understanding (Segal, 2011). However, the research is more limited when it comes to understanding young children's *play* using touch-screen tablets (whether at home or school).

In the aforementioned NAEYC/FRC joint position statement, the authors call for more research on how children interact with these latest tools: "Research is needed to better understand how young children use and learn with technology and interactive media and also to better understand any short- and long-term effects" (p. 11). Specifically concerning multi-touch technologies, the organizations state a need for research on "what young children are able to do and how these tools and media can be integrated in a classroom" (p. 11). The ways children explore and use these newest tools has not yet been thoroughly studied. Needed are understandings of children's interests, processes, actions, and interaction while engaging with such technology, and the NAEYC/FRC notes that such interactive engagements should be offered in a playful way. To begin to address these needs, I examine children's interests, explorations, uses, and creations as they play using touch-screen tablet technology. Before explaining the specific research questions and definitions, I address the purpose, rationale, and potential contributions for the study.

PURPOSE

The purpose of this study is to develop a greater understanding of young children's classroom-based choices and interactions as they play using touch-screen tablets equipped with applications that afford children opportunities to engage in symbolic play. While there are many types of applications targeted toward young children's experiences with traditional learning tasks such as practicing letter names, letter sounds, colors, shapes, the applications (apps) I have chosen to study are those that allow children to explore, interact, and create in more open-ended ways. The selected apps are ones that allow for construction play (object- and material-based "building" play of many types) and/or dramatic play (role-play, pretend play). Play research could be informed by further exploration of the affordances and/or limitations available through these types of open-ended digital symbolic play opportunities.

Rationale for the Study

This study's examination of children's choices and interactions in and around a digital space offers a new context for play-based research, and can inform the discourse on technology integration in early childhood classrooms as well as the discourse on play. Even as the research field races to study the uses and affordances of these latest tools, schools around the country are beginning to invest thousands of dollars in tablet technology—with some schools' leaders including them in early childhood classrooms (e.g., Hawes, 2012; Magen, 2012). Teachers and policy makers need more information on how children interact with these devices and programs so they can make informed decisions on which technologies might best serve children's "active, hands-on, creative, and authentic engagement" experiences (NAEYC & FRC, 2012, p. 11). In addition to the growing amount of data on other types of technology inclusion (e.g., digital cameras, computers, internet-based learning environments) in early childhood classrooms (for an overview, see Wang & Hoot, 2006), it seems necessary to gather data on children's interests and interactions around touch-screen tablets (and associated apps) as children play using these digital tools. In order to make a sound argument about how and when existing technologies can serve young children's play and learning, we need to investigate more closely how children interact with these tools and with each other, and how these tools may or may not offer unique opportunities for exploration and authentic engagement. The current study offers needed evidence of the nature of children's purposeful play using technology, as it examines children's digital play with tablets and open-ended symbolic play applications. It tracks children's interests, actions, and talk as they engage with multi-touch tablet technology in their play.

Potential Contributions

My close examination of children's interactions, talk, and creations with this new technology-related material adds to the field of play research by closely examining open-ended play with a new material—a touch-screen tablet. While this exploratory study gathers information on only one particular group of pre-kindergarten children in one public school classroom, it offers insights into some of the ways children acclimate to and move about in and around a digital play space. The findings document students' interests, choices, and how they take up digital play activities for their own purposes. These data and the developing theoretical model provide insights that can help inform early childhood classroom practice, policy, and teacher education so that researchers, practitioners, policy makers, and leaders can make informed decisions on technology integration in early childhood classrooms (Rosen & Jaruszewicz, 2009).

The current project uses a classic grounded theory approach in order to allow young children's gathered concerns, perspectives, and interests to emerge. Paying attention to students' interests as revealed through their choices and actions allows for privileging children's perspectives in research on children's play. This study is significant not only for what it tells us about children's processes and experiences, but also for pointing toward what we need to continue to learn about their perspectives, interests, concerns, and meanings as they make choices and take actions in their technology-centered play.

DESIGN OF STUDY

To investigate children's interests and actions in digital play, I chose to observe four- and five-year-old pre-kindergarten students in a single early childhood public-school classroom as they interacted with tablet technology and selected apps that invite symbolic play. I purposefully chose to examine children's technology-related play in a classroom setting so as to gain more understanding of children's classroom-based technology play. To guide my data collection of children's interests, actions, and creations during this digital play, I developed the following two research questions:

1. In what ways do preschool children interact and engage with open-ended, symbolic-play related applications as indicated through their talk, actions, and interactions?

2. How does the classroom context seem related to the children's decisions, actions, and engagement with open-ended apps?

To understand children's engagement with open-ended iPad apps, selected to offer playful invitation, I collected the following data from the classroom, teacher, children, interactions, and tool: video data of student talk, gesture, interaction, application manipulation, and resultant products; field notes of the classroom context; interview data from the teacher; and survey data from parents. The primary data sources include video data of students' physical actions/gestures, talk, and their interaction with each other and the applications over time, paired with screen-capture data of program responses to children's actions.

This study was conducted using the principles of classic grounded theory (Glaser, 1978, 1992, 1998; Glaser & Strauss, 1967) to guide data collection process and analyses. Classic grounded theory not only suggests certain principles for data collection and coding processes, but also a certain stance toward the literature and possible theoretical frameworks. When using this approach, the review of literature should take place after data collection has begun and substantive categories have started to emerge through the constant comparison of data. Glaser (1998) notes:

> Since grounded theory generates hypotheses from data and in no way tests theories found in other literature, it is appropriate to deliberately avoid a literature review in the substantive area under study at the beginning of the research. This dictum is brought about by the concern not to contaminate, constrain, inhibit, stifle, or otherwise impede the researcher's effort to discover emergent concepts and hypotheses, properties and theoretical codes from the data that truly fit, are relevant and work. He is free of received or preconceived concepts that may really not fit, work, or be relevant but appear to do so momentarily. (p. 68)

Although research questions, review of literature, and theoretical constructs may be laid out at the beginning of a grounded theory study, they are offered with the understanding that the grounded theory process in tandem with the data collection and continuous data analysis may give rise to modifications in initial questions and constructs. In response to this methodological perspective, I began with an initial general overview of play and technology literature, although I did not design my study to align with a single play theory. As the study progressed, I worked to develop my own theoretical model and continued to review existing and emerging studies for possible confirmation of or contrast with my findings. I supplemented my initial review of research with additional literature as the study progressed in order to compare my developing theory against existing play theory and technology-play related theory.

Definition of Relevant Terms

Applications (***Apps***) – These are tablet-based computer software programs that are available for download via an online store. There are both free and paid apps, and new apps are added to the online store almost daily [a January, 2011, *New York Times* article numbered the available educational applications at 5,400 (Hu, 2011)]. Some developers update their applications periodically to respond to user ratings and feedback about usability and problems. An increasing number of applications are being designed to appeal to children, and there are teachers (e.g. Addis, 2012; Andrews, 2012; Gomez, 2012), parents (e.g. Taylor, 2012), organizations (TCEA, 2012), and instructional technology specialists (e.g. Barker, 2012; Christo, 2012; Johnson, 2012a; Johnson, 2012b, Swanson, 2011) who have begun to review these applications so as to inform users of the content, function, and usefulness of particular apps aimed toward children. The applications chosen for use in this project (and rationale for such choices) are explained in Chapter 3.

Construction Play – This is a form of play in which players build or create with concrete (or digital) objects. Examples of construction play include building with blocks, painting, drawing, sculpting with clay or sand, sewing, and weaving.

Digital Space – This includes the images and interactions possibilities provided for on a screen. Rather than a concrete, physical space, in a digitized environment, objects are not something one can hold in his/her hands, but are, along with physical space, represented by images on a screen. Digital space is related in some ways to virtual worlds (which also include digitized spaces), but does not have to be part of a virtual world (which often include online and social networking aspects). In this study, the digital space was not connected to any online social interaction.

Dramatic Play – Known by many names, including pretend play, imaginative play, pretense, role-play, and sociodramatic play, this is a form of play in which children take on roles and often transform objects and the environment using "as if" behaviors (Bateson, 1955, 2000; Garvey, 1990).

Play – The perspective of play to be used in this study is a broad one based on the review of play theory by Rubin, Fein, and Vandenberg (1983) that includes three approaches: play as disposition, observable behavior, and context. The findings expand on this definition to include play interactions observed as children interacted with apps on a tablet, and with each other. A more detailed definition of play is shared in Chapter 2.

Interests – The perspective of *interest* in this study is one that includes aspects of affect, cognition, seeking behaviors, and the environmental situation (see Hidi & Renninger, 2006). As noted by Hidi and Renninger (2006), "The potential for interest is in the person but the content and the environment define the direction of interest and contribute to its development." (p. 112) Students' interests in this study are considered to be situated within the social context in which they occur.

Social Context – In this study, *social context* includes the classroom setting and the research activity center that was organized around two parallel, identically-prepared tablet devices. Students were able to call over a tablemate of their choosing, in alignment with the findings of Chen (2011) that children can collaborate around computers and do so with more cooperative behaviors when seated beside friends.

Technology – For the purposes of this study, *technology* is used to refer to objects used as tools (such as compact disc players, televisions, computers, touch-screen tablets), and the associated products used with these tools (i.e., compact disks, television programs, software, etc). According to Rooney (1997), the Greeks, Weber, Foucault, and others defined technology as object/tool, and/or actions, and/or knowledge, and/or signs (and usually an intermingling of all these elements). Although these many nuanced and interconnected aspects can never truly be separated from one another, I focused in this study on the objects and associated products.

Tool – For the purposes of this study, a tool includes the touch-screen tablet device, the specific application, and even the symbol a child draws or chooses from existing art to represent a character, object, or idea. Depending on the situation, the tool may be something that provides information, or allows for expression of information. This is influenced by Salomon and Perkins' (1998) conception of tool as a "social mediator of learning" that is imbued with cultural context and history, and can include "not only physical implements but technical procedures (e.g., the algorithms of arithmetic) and symbolic resources (e.g., those of natural languages and mathematical and musical notation)" (p. 10). The tool can help provide information to the user, or can help the user express information.

Touch-screen tablet – This is a specific type of digital, hand-held, or mobile computing device, usually containing a minimal number of buttons (compared to desktop or laptop computers), with minimal additional peripherals (e.g., keyboard, mouse, stylus) needed for device manipulation. All software programs on the device can be manipulated by touching the screen and using various swiping, sliding, pinching, and tapping moves. Certain software comes preloaded on the device, and some devices allow for additional software purchases.

CONCLUSION

This study of children's approaches, interests, experiences, and playful actions centered on a new technology device was designed to contribute to conceptions of play within the field of the early childhood education. Its questions and findings have been informed by a foundation of play research and theory, and by research conducted around children's interests and actions in their exploration and play. In the next chapter, I review relevant research on young children and technology, as well as young children's exploration and play, focusing on two particular types of play that hold promise for studying children's open-ended exploration of apps – construction play and dramatic play. I also review existing research on children's interests and actions during technology-related play, as well as the larger body of play research and theory. In addition, I explain classic grounded theory and why it seemed a useful methodological approach for an exploratory study of a new play space. These foundations lay the groundwork for the study's beginnings. In the final chapters, I share the inquiry pathway through the data collection, analysis, and theory development around children's tablet-based play.

Chapter 2: Review of Related Literature

Overview

As computers and digital technology have become more prevalent in young children's lives in many cultures, research has begun to examine young children's play in and around a digital space, be it their computer play with programming games (Genishi, 1988, 1989; Genishi & Strand, 1990), software games (Davidson, 2010; Labbo, 1996; Takeuchi, 2012; Verenikina, Herrington, Peterson, & Mantei, 2010), or online games (Marsh, 2010; Takeuchi, 2012; Wohlwend, Vander Zanden, Husbye, & Kuby, 2011). Even more recently, researchers have begun to examine young children's experiences with a particularly accessible—to users young and old—interactive computer technology: the touch-screen interactive tablet (e.g., Lynch & Redpath, 2012). In addition to children's access to touch-screen phones and tablets in some homes, these tablets (e.g., Apple iPad, Kindle Fire) are becoming a part of children's school experiences in recent years (e.g., Chung, 2012; Hawes, 2012; Hu, 2011; Magen, 2012; Tayborn, 2011). Furthermore, program developers have increasingly designed and targeted particular programs ("apps") specifically toward children—including those labeled by developers as "entertainment" and those labeled as "educational." Hu (2011) noted that there were 5,400 educational apps available for the Apple iPad in January, 2011. In contrast, my own quick search of the Apple App Store in March of 2014 revealed 70,493 apps listed in the "education" category alone. Despite the proliferation, these applications vary widely in their affordances for learning and exploration, as well as their likely appeal to children.

Although many digital-play possibilities exist for children, some early childhood experts and physicians are wary of *any* technology integration in young children's exploration and play experiences (American Academy of Pediatrics, 2011; Healy, 2000). Reasons for caution include concerns over excessive screen time, inhibition of social development, and reduced physical activity. The NAEYC and FRC address these concerns, citing research findings and position papers, as they make suggestions for practitioners on how to deal with such concerns in child-centered, healthful, and developmentally appropriate ways (NAEYC & FRC, 2012). The joint statement also notes that there is still more room for systematic inquiry into children's uses and experiences with technological devices such as a touch-screen tablet.

Even when early childhood experts do condone some use of digital technology with young children, concerns remain as to the limitations of software for exploration and experimentation (e.g., Healy, 2000). Johnson and Christie (2009) elaborate on this issue:

> Software targeted at children needs to be problem-solving oriented and open ended. Software should provide 'micro-worlds' where children have choices to explore and opportunities to follow their curiosity and make things happen. Programs should not be drill and practice because these closed-ended programs limit children's initiative and decision-making. Open-ended programs do not ask children to determine a single right answer. Rather, they encourage children to explore and extend their thinking. . . . Software that facilitates children's playfulness stimulates imagination, creativity, challenge, and curiosity. Open-ended software allows children to engage in creative play and conversation. (p. 286)

These authors echo the concerns of many early childhood experts who are firmly committed to offering young children opportunities to explore, experiment, and play with a variety of tools and materials so they can begin developing their own understanding of the world (Copple & Bredekamp, 2009; NAEYC, n.d., 2009). This concern over the possible limitations of computer software to provide open-ended exploration opportunities seems a legitimate one, especially with regard to iPad applications. Although a large number of education-related applications are available, there is little evidence to account for how many apps actually allow for open-ended exploration by children. Because this technology is new, there are few state-of-the-art summaries of education applications available. Watlington (2011) provided a limited overview of the types of apps available, but a perusal of applications recommended by teachers (e.g., Addis, 2012; Andrews, 2012; Gomez, 2012), parents (e.g. Taylor, 2012), organizations (TCEA, 2012), and instructional technology specialists (e.g., Barker, 2012; Christo, 2012; Johnson, 2012a; 2012b, Swanson, 2011) indicates many categorizations and types of educational applications. The range of applications includes interactive books, gamified literacy apps (e.g., letter-sound matching, letter tracing, memory games), gamified numeracy apps (e.g., counting, sorting, one-to-one correspondence), gamified science apps (e.g., physics apps), vocabulary apps (e.g., sorting/naming animals, colors, objects), theme-related task-completion games (e.g., buying items in a grocery store, taking care of animals at a veterinarian's office), and puzzles (e.g., shape, word, and number-related puzzles). In the gamified concept-related apps, there is usually a task children have to complete for which they receive some type of reward (e.g., sounds of cheering, acquisition of stickers or trophies, or progression to the next level) (see Lynch & Redpath, 2012).

Besides these examples of various types of task completion games (with program-generated tasks and subsequent rewards), there are also more open-ended applications, such as drawing and painting apps, as well as apps for book-making and/or story-creation, animation creation, picture-creation, block-building, voice recording, and music creation. In the more open-ended apps, the user has some freedom to make choices and create products (although the user is restricted by the existing tools, creation modes, and space provided within the application). For example, in the drawing program, *Doodle Buddy* (2011), a user (or simultaneous users) can freely draw and change a picture using a variety of tools (paint, chalk, glitter, smudge, erase) with a choice of colors and brush widths, and add a variety of pre-programmed objects (stamps, shapes, backgrounds, letters). In *Pattern Blocks* (2012), a user can create block patterns with a variety of shapes (similar to the wooden, painted pattern blocks found in many schools) on a variety of backgrounds, and add drawings via four marker colors. In *Toontastic* (2012), a user can create and record an animated cartoon using program generated or user-created backdrops and characters, choose between a limited number of music accompaniments, move characters about, and add voice-over. In each of these examples of more open-ended apps, the user has some choice about which tools to use and what will be created. However, a user is still limited by the tools available in the program, the two-dimensional screen representations, and the tactile limits of digital (versus physical) materials. For example, in a drawing program, children cannot smell the paint, squish it between their fingers, mix paints together, or add other media (e.g., yarn, cut paper, buttons, etc). By design, children can use only the media available. And as they construct images in digital space, all media, whether paint, pencil, chalk, glue, or eraser feel the same—cool, smooth, glass against finger or stylus. Thus, although these types of applications are more open-ended, they are still constrained in some ways.

Even so, with digital media, no paint color runs out, brushes are always clean, colors flow evenly, and move away just as readily. These are features that might be of interest to young children, and thus researchers might yet learn from children's use of open-ended applications, as well as from their interests and intentions around such experiences. Furthermore, such exploration can inform and deepen our understanding of play to examine the actions and interactions of children interested in engaging with such applications. To develop and situate the current study in a theoretical research base, I begin with an overview of how I situated "play" in this study, followed by a review of the related literature on young children's exploration and play, and the concept of symbolic play. I then review research on two particular types of symbolic play that have been frequently studied as a means for children's open-ended exploration—construction play and dramatic play. I also explain why I chose these two play forms for this particular study with young children (four- and five-year-olds) and include a brief discussion of children's responses to non-digital construction/dramatic play to indicate my stance toward the digital forms of these two types of play. I then review the literature on existing technology-related play studies with young children, including studies on students' personal interests, social interactions, and play actions. Following this, I explain how my study is situated within this existing research landscape.

At the outset of the study, I did not yet know what would emerge from the data as key processes and children's main concerns as they played with construction and symbolic play applications on touch-screen tablets. The classic grounded theory approach (Glaser & Strauss, 1967; Glaser, 1978, 1992, 1998), allowed for this type of emergence and was chosen for this exploratory study in a substantive area (play) with a new category (digital play). I conclude this chapter with a review of this methodological approach.

PLAY

Because the purpose of this study was to examine young children's technology-related play choices and actions as they occurred with touch-screen tablets in a classroom setting, the examination is situated in the larger field of play research. Researchers have long noted the difficulty in defining 'play' (see Frost, Wortham, & Reifel, 2012; Gilmore, 1971; Power, 2000; Rubin, Fein, & Vandenberg, 1983). One reason for the difficulty is the variety of disciplines that include play as a construct to be studied, with the associated differences in foci of the researchers. Play has been studied by psychologists (Garvey 1990, Hall 1906; Piaget 1962; Vygotsky 1976, 1978), psychoanalysts (Erikson 1985; A.

Freud, 1966; S. Freud, 1920; Peller, 1954), anthropologists (Schwartzman, 1978), sociologists (Parten, 1933), play theorists (Sutton-Smith, 1997), folklorists (Opie & Opie, 1969), play therapists (Axline, 1981, 1986; Landreth 2012), educational researchers (Moon & Reifel, 2008; Neuman & Roskos, 1992; Ness & Farenga, 2007; Nicolopoulou, Barbosa, Ilgaz, & Brockmeyer, 2010; Tobin, Hsueh, & Karasawa, 2009), and teacher-researchers (Paley 1988, 1992, 2004), to name a few. These varied fields have offered a variety of ways to think about, define, and examine play. More specifically, in education-related fields, play has been associated with a variety of foci on different developmental domains including social (Dewey, 1990, 1998; Froebel, 1905, 1907; Parten, 1933; Smilansky, 1968; Smilansky & Sheftaya, 1990), emotional (Erikson, 1985; Freud 1920; Peller, 1954), physical, and cognitive aspects (Piaget, 1962; Singer, Michnik Golinkoff, & Hirsh-Pasek, 2006; Vygotsky, 1976). At the same time, there are also many theories about non-developmental aspects of play, in which play is viewed as a way to expend energy (Spencer, 1873; Schiller, 1875), relax (Lazarus as cited in Gilmore, 1971), replicate one's genetic past (Hall, 1906), and express oneself (Sutton-Smith, 1997). In addition, theories abound on how play can reflect and/or enhance communication (Bateson, 2000; Garvey, 1990; Corsaro, 1985), and can be evidence of cultural perspectives (Huizinga, 1955; Opie & Opie, 1969; Schwartzman, 1978; Riojas-Cortez, 2001; Roopnerine, Lasker, Sacks, & Stores, 1998; Tobin, Hsueh, & Karasawa, 2009), and gendered perspectives (Eliot, 2009; MacNaughton, 1999; Reifel, 2009) (see Frost, Wortham, and Reifel, 2012 for a much more extensive review of the rich history and varied theoretical traditions around play).

Rubin, Fein, and Vandenberg (1983) reviewed many studies and theorists' perspectives on play, and included an argument that there are three types of play definitions, “play as disposition, play as observable behavior, and play as context” (p. 694). Rubin et al. explained:

> Three general approaches to the definition of play have been attempted. In one, play is defined according to the psychological disposition or set presumed to mark its occurrence and distinguish it from other types of behavior. In another, play is defined according to observable categories of behavior buttressed either by specified behavioral criteria or by a more intuitive identification process (e.g., Matthews & Matthews, 1982). In a third, play is defined according to the context likely to evoke the disposition or likely to yield one or more of the behaviors identified as play. Although these definitional approaches are not without problems, they reflect the widely shared notion that the entity *“play”* is *a behavioral disposition that occurs in describable and reproducible contexts and is manifest in a variety of observable behaviors*. (p. 698, italics in original).

Power (2000) reviewed and summarized Rubin, Fein, and Vandenberg’s (1983) three approaches and noted: “because few examples of play include all (or even most) of these features, and one or more of these characteristics are often found during nonplay, Martin and Caro (1985) argued that play is ‘polythetically’ defined, and therefore difficult to define by its individual attributes alone” (p. 5). This exemplifies the difficulty in defining play or labeling behaviors as play (or exploration, or nonplay).

Rubin, Fein, and Vandenberg (1983) described the “play as observable behavior” approach to include “taxonomies of behavior in which are described distinctive types of play” (p. 700). In the current research project, I began with a “play as observable behavior” perspective, keeping in mind the taxonomies of Piaget (1962) and Vygotsky (1976, 1978) as well as more recent iterations of these taxonomies and others, such as Trageton’s (2005) explanation. Trageton (2005) included forms of motor manipulation: “functional play, psychomotor play, practice play, introduction play,” pretend: “role play, sociodramatic play, make believe,” constructive manipulation: “constructional play, play with materials, building play,” and rule based play (p. 161). These various forms of play influenced the apps I selected and the types of play I thought I might see.

Rubin, Fein, and Vandenberg (1983) described the “play as context” approach to include “what adults of a given culture hold to be play” (p. 700), and how they in turn organize a setting to include opportunities for play. Rubin and his colleagues noted five elements:

> (1)…materials likely to engage children’s interest; (2) …free[dom] to choose from the array whatever they wish to do within whatever limits are required by the setting…(3) adult behavior that is minimally intrusive or directive; (4) a friendly atmosphere designed to make children feel comfortable and safe; (5) scheduling that reduces the likelihood of the children being tired, hungry, ill, or experiencing other types of bodily stress. (p. 701)

I also arranged the study to include a “play as context” environment, by arranging the study to include a particular engaging material (iPads and open-ended iPad apps), and procedures that allowed children’s choice to come (or not) to a research iPad center (to be described in the next chapter), students’ free choice to select and engage with available apps as they desired, with minimal adult direction, and scheduled at a time when children’s “appetitive needs” (Power, 2000) had been met. Even so, students’ choices were constricted in that only researcher-selected apps were available—apps that may or may not have been of interest to individual students.

Concerning the “play as disposition” approach, Rubin et al. (1983) included six factors that “serve to distinguish play according to its motivational source and according to the organism’s orientation to goals, physical stimuli, rules, and nonplay behavior” (p. 698). The six features include: 1) play as “intrinsically motivated,” 2) play as “characterized by attention to means rather than ends,” 3) play as different to exploration as it is “organism rather than stimulus dominated,” 4) non-literal and simulative, 5) “freedom from externally imposed rules, and 6) participant must be “actively engaged in an activity (pp. 698-699). I add an additional element by suggesting the “play as disposition” characteristic is dependent on the perspectives of the children themselves.

Opportunities for "play as disposition" were provided by arranging a center in which children could choose to come and engage actively with the available apps of most interest to them (intrinsic motivation and active engagement) with few externally imposed rules, with open-ended iPad apps that allowed for student exploration and attention to means over ends (no gameified apps). Students could engage in non-literality and simulation as it was of interest and use to them. I diverge from Rubin and his colleagues on the issue of exploration as separate from play (to be discussed in the subsequent section). Furthermore, I argue that the children's own interests and perspectives—as indicated through their choices, actions, and talk—were an important additional indicator as to whether they took up a "play as disposition" perspective.

In defining play for this study, it was also important to note the philosophical underpinnings influencing my organization of the study and analysis of children's actions and choices. Because this study was conducted in a school setting in which play is considered a medium for children to explore and learn about their world, the topic of play is situated within a "play as progress" rhetoric (Sutton-Smith, 1997). This is a particular cultural perspective from a theory of "play rhetorics" developed by Sutton-Smith (1997) who sought to address the multiple theories, dimensions, and perspectives of play across multiple cultures. He explained that these play rhetorics are "underlying ideological values" that "express the way play is placed in context within broader value systems, which are assumed by the theorists of play rather than studied directly by them" (p. 8). He noted that much research and theory about play has centered around a "play as progress" rhetoric in that play is linked to learning and development (pp. 38 – 40).

Considering play as a medium for children's learning and development has been both promoted as essential to young children's educational experience (Copple & Bredekamp, 2009) and critiqued as a "psychological construct that, when described in stages or cognitive structures, limits possibilities in ways that are similar to the notion of child development" (Cannella, 2002, p. 124). Cannella went on to note, "Our constructions of play assume linearity, universal human behavior, unidirectional progress, and standards of normalcy . . . play can be further problematized as the artifact of a particular culture whose beliefs about younger human beings are not necessarily applicable to all" (p. 124). She suggested we should both question and problematize dominant perspectives on play. I respond to this challenge by suggesting that considering only singular definitions of play—such as a Piagetian developmental perspective, or Vygotskian sociocultural perspective, or Eriksonian socio-emotional perspective—might not allow for the multiple possibilities of the verbalizations, actions, interactions, and perspectives that might count as "play." Thus, activities that do not characteristically fall into a dominant construction of a particular type of play—such as pretense-related play that does not perfectly exemplify a Piagetian conception of symbolic play—might not be deemed by observers as "play." In my study, I sought to avoid culturally monolithic perspectives of play by continuous examination of what counts as "play," and consideration of children's own perspectives as evidenced through their actions and talk.

In order to consider actions that might not fit traditional definitions of play, but that children themselves might deem as play/playful, I considered the additional play rhetorics noted by Sutton-Smith (1997). Even though the "play as progress" rhetoric is a powerful and pervasive one, particularly in schools and early childhood education (see Copple & Bredekamp, 2009) and early childhood education research, Sutton-Smith (1997) noted that play often functions in other ways as well (fate, progress, identity, imaginary, self, frivolity). This is an important point as children may have other goals, orientations, and reasons guiding their exploration, talk, actions, and creations as they "play" in the classroom and in a digital space. Therefore, for this study, I worked to consider children's dispositions and perspectives that might not fit neatly into any "play as progress" rhetoric and the associated Western play theorists (e.g., Piaget, Vygotsky, Dewey, and others). As noted above, play as a general concept has many possible definitions and theoretical underpinnings, and the players themselves may have different ways of defining, naming, and enacting it. In my study, I have worked to keep these multiple possibilities close at hand, so as to avoid culturally monolithic perspectives of play within a classroom play setting.

Even while holding the multiple play perspectives and play possibilities in mind, I was influenced in my selection of apps for children by a child-centered, open-ended exploration, "play as progress" perspective. In addition, I organized the study to allow children possibilities to engage with apps that allowed for types of play as exemplified in play taxonomies such as those of Piaget (1962, 1967), Vygotsky (1976), and their followers. That is, I selected apps that would allow for children to engage in symbolic play via dramatic and construction play. Before presenting an interpretation of symbolic, dramatic, and construction play, I first review research on the concepts of play and exploration. Students' experiences with the study-related apps were to be their first encounters with these selected programs, and thus it is important to explain my conceptions of the interrelated concepts of play and exploration.

Play and Exploration

> Well, you mentioned earlier something called 'practice.' That's a difficult thing to be objective about. And there are other things that are difficult in the same sort of way. *Play*, for example. And *exploration*. It's difficult to be objective about whether a rat is *really* exploring or *really* playing. So they don't investigate those things. (Italics in the original; Bateson, 2000, p. 47)

In this quote from Bateson's (2000) father/daughter vignettes, the father indicates the difficulty of distinguishing objectively between exploration actions and play actions.

Review of the literature confirms that researchers *have* found it difficult to sort and distinguish between exploration and play. Some researchers, like the father in Bateson's vignette, conceptualize exploration as a separate activity from play, whereas others situate it as a part of play. The following paragraphs will review important studies and their influence on the current study.

Hutt (1971) reviewed the differing definitions of "exploration" and the ways that scholars have connected exploration with play. She explained the argument over whether exploration is the same thing as play, is a type of play, or precedes play, and reviewed various theories on the behaviors, conditions, and features of exploration. In her own study of preschoolers' exploration of a specially-created novel object, she determined that exploration has for its goal a "stimulus referent" in which a child tries to figure out the properties of the object, whereas play has a "response referent" in which a child tries to figure out what s/he could do with the object (p. 241-242). In reference to her participants, she explained,

> In all children, once active investigation had commenced, it generally proceeded vigorously, all aspects of the object being explored. It was only once the child had apparently learned all there was to know about the object that it was incorporated in play activities, and any further learning was purely incidental" (p. 241).

Hutt also noted differences in affect, and stated that as children move from exploration to play, their facial expressions and behavior toward the object move from concentration to relaxation and finally "nonchalant" affect (p. 242). So for Hutt, play and exploration are separate activities, with different goals and affective states.

Others, too, have posited this theory of play and exploration as separate activities, situating exploration as a precursor to play (e.g., Escobedo, 1992; Fromberg, 1992; Wohlwill, 1984). In a study of young children's play, exploration, and talk around physical and computer-based drawing materials, Escobedo (1992; 1999) based her study on Wohlwill's (1984) conceptions of play and exploration. In her review of the literature (1999), Escobedo explained, "the sequence of extracting information from materials through exploration follows three phases: exploration of materials through inspection, to manipulation (which may include experimentation), and then to play" (p. 104). She defined exploration as a separate activity and precursor to play, and coded children's drawings (physical and digital) "into categories of Nonplay (Exploration and Manipulation) and Meaningful Play" (p. 107). Escobedo then linked these types of play with her earlier research on the stages of children's computer generated art, explaining that, "exploration and inspection were evident mostly in graphics categorized at the Scribbling stage, manipulation and experimentation were evident in graphics at the Basic Forms stage, and meaningful play behaviors (including construction with objects and fantasy) evident in those drawings at the Pictorial stage" (p. 107). In her earlier (1992) study, she also noted a possible progression from exploration → manipulation → symbolic play (evidenced by transformation of objects for construction or pretend. For Escobedo (1992; 1999), then, exploration was separate from play. In both studies she found the younger children (aged 4) evidenced more exploration activities than the older participants (aged 5) who engaged in more "meaningful play behaviors" via construction with objects and fantasy. Interestingly, when making her argument (1999) as to why some forms of artistic creation could be categorized as a type of play, she cited Branscombe's research in which children engaged in art activities viewed their experiences as play—they named it "play" and said that it was "fun." However, she did not then extend children's own perspectives toward the concepts of exploration versus play. She only noted that "play is not exhibited until exploratory activity has occurred; in exploration, children discover what the material does, and in play, they discover what they can do with it" (p. 104). Children's perspectives on whether or not their exploratory actions were simultaneously a form of play were not considered.

Fahndrich and Schneider (1987) also separated the constructs of play and exploration. For these researchers, exploration included "looking, visual inspection, touching, and manipulation" whereas play included "unconventional manipulation of the novel object, incorporation . . . or transposition of function" (p. 212). They found that children demonstrated similar levels of interest and attention in both play and exploration, with more expressions of mental attention (drawing together the eyebrows) in exploration and more expressions of joy (cheeks raised and corners of mouth pulled back and up) in play. Joy expressions were found in both categories. Thus, they noted, "the construct of interest, therefore, is too broad to be helpful in the discrimination of playing with and exploring a novel object and the associated cognitive-emotional states" and that "although facial expressions of joy discriminated between exploration and play, the children did show an appreciable amount of joy and only a few signs of negative emotion during exploration" (p. 215). Although these researchers considered play as separate from exploration, their work indicates that affective states and the construct of interest might reveal more similarities between play and exploration than differences. This indicates the blurring of lines between exploration and play activities.

Wiesler and McCall (1976) reviewed the literature on the concepts of play and exploration and noted that trying to sort episodes of children's exploratory play into "discrete categories of exploration and play" might be "quite difficult and not very useful" (p. 497). They explained that "exploration and play may become admixed in natural behavior patterns" and "some of the factors that have been said to mark the distinction between play and exploration may not do so consistently" (p. 497). This is not to say that exploration and play should not be studied, but that it might be difficult to separate out discrete differences in behavior ("exploration" versus "play") when watching children in action. Thus, whereas researchers like Hutt (1971), Fahndrich and Schneider (1987), and Escobedo (1999) made clear distinctions between play and exploration, Wiesler and McCall (1976) noted that such clear distinctions may not truly exist, and that separation might not be very useful.

It is possible that adults' definitions of play and exploration, and their conceptions of the actions that constitute play versus exploration may be different than those of children. Holmes (1999) studied adults' and children's conceptions of play and work at home and at school, and found that although adults had varied responses to the activities and actions they viewed as play at home and at school, kindergarten children were more aligned in their explanations of play. They noted that play activities were those "engaged in with friends (notably peers), whereas an activity performed for and with the teacher was perceived as work. For all of the children in this sample, play activities were distinguishable from other activities because the former possessed the criteria of 'fun' and were freely selected" (p. 65). Holmes included a quote of one student who, when asked about the difference between work and play, responded, "When you play, you can do anything you want. Work is when you do everything the teacher says" (p. 65). Although Holmes was studying children's definitional differences between play and *work* (rather than play and exploration), it is possible that children could also conceive of exploration activities as play (or work) even when researchers conceptualize it as separate from play.

To reiterate, the goal of the present study was not to distinguish the mental processes of exploration from those of play. Instead, this research built upon the possibility that exploration is not separate from play, but *can* be a part of play—or at least can require a playful attitude. Erikson (1972) linked playfulness, exploration, and experimentation as he reflected on young children playfully experimenting in one teacher's classroom: "Such experimenting, however (as I felt strongly when watching Baerbel Inhelder in Geneva induce children to be experimental), relies on some playfulness and, in fact, on an interplay of the child's inner resources with the nature of the task and the suggestiveness of interviewers who are 'game'" (p. 132). In this example, there is again, a mixing of concepts and constructs, in which discrete behavioral differences between play and exploration are not elucidated, nor is there a claim that they should be. Thus, it seemed to be of more use for the current study to allow exploration and play to blur as necessary to explain children's engagement with iPad apps.

Symbolic Play

Situated within the larger field of research on children's play, the term "symbolic play" is used by theorists to indicate actions "in which a child has a signifier represent something else, a signified" (Pellegrini & Galda, 1993). To explain the particular meaning and use of the concept of symbolic play in this study, I briefly overview the theoretical traditions upon which the current project rested. I then discuss two forms of symbolic play, construction play and dramatic play, that are often provided for in early childhood classrooms, and that influenced my design and observations in the research classroom.

Piaget (1962) connected *symbolic play* with the child's developing cognitive abilities, and noted its appearance as indication that the child's cognitive schemas about the world were changing to include not only sensorimotor elements, but representational elements as well. He explained in explicit detail the progression of sensorimotor assimilation and accommodation, and the changing mental structures that allow a child to develop representational thought and expression. In his writings, symbolic play was exemplified as an assimilative activity in which a child uses one thing to represent another that is not present, from pretending a cloth, collar, or rubber donkey tail is a pillow (1962, p. 96), to pretending one's hand moving a shell across a cardboard box represents a cat walking across a wall (Piaget, 1976, p. 565). And in this activity, the make-believe substitution of objects would be "merely assimilated to the ego, i.e., it is evoked for temporary interest or for immediate satisfaction" (1976, p. 566). It allows the child to "relive his past experiences," it "makes for the satisfaction of the ego," as well as "provides the child with the live, dynamic, individual language indispensable from the expression of his subjective feelings, for which collective language alone is inadequate," and it allows a child to express his or her "individual truth as opposed to collective and impersonal truth" (p. 568). In Piagetian theory, symbolic play includes representational actions that, when observed, can be clues to a child's interests, desires, and understandings based on past experiences, and it can be a way that a child expresses his/her current thinking.

Vygotsky also discussed symbolic play, but from a somewhat different perspective. Vygotsky's conception of symbolic play was rooted in his belief that play indicates a combination of issues including children's needs, interests, inclinations, motives, affect, and their responses to all these issues (Vygotsky, 1976). For Vygotsky, play occurs when children have unfulfilled desires they feel a need to gratify:

> Toward the beginning of preschool age, when desires that cannot be immediately gratified or forgotten make their appearance and the tendency to immediate fulfillment of desires, characteristic of the preceding stage, is retained, the child's behavior changes. To resolve this tension, the preschool child enters an imaginary, illusory world in which the unrealizable desires can be realized, and this world is what we call play. (Vygotsky, 1978, p. 93)

Symbolic play includes children's motivations and affective incentives (to fulfill or gratify desires immediately), a contextual situation (inability to fulfill said desires), and a behavioral response (to create an imaginary situation where s/he can pretend the realization of said desires) (Vygotsky, 1976). However, even in this space, which includes imaginary events and actions, there are sociocultural rules children inherently follow based on their own cultural context (a mother behaves like "X", or sisters do "Y"– see Vygotsky, 1976, pp. 541-542). Symbolic play includes an imaginary element (that for Vygotsky, occurs because a child has desires s/he wants to gratify). The play includes rules (bound by the child's sociocultural context), and it contains new combinations of thought and action whereby

> …the child sees one thing but acts differently in relation to what he sees. Thus, a condition is reached in which the child begins to act independently of what he sees. . . . In play, thought is separated from objects and action arises from ideas rather than from things: a piece of wood begins to be a doll and a stick becomes a horse. Action according to rules begins to be determined by ideas and not by objects themselves. (Vygotsky, 1978, p. 97)

At first, in this new perception ability, the child will use, according to Vygotsky, a *pivot*, or object, to help him or her separate meaning from an actual object: "in order to imagine a horse, he needs to define his action by means of using 'the-horse-in-the-stick' as the pivot" (p. 97- 98). This use of a pivot is the signal that the child's perceptions are changing from the object suggesting meaning to the meaning holding sway over the object. However, Vygotsky noted that a child cannot use a "symbol" in the way that an adult can, i.e., he or she cannot use any object to represent a horse. He explained, "A symbol is a sign, but the stick does not function as the sign of a horse for the child, who retains the properties of things but changes their meaning. Their meaning, in play, becomes the central point and objects are moved from a dominant to a subordinate position" (p. 98). Pivots are elements that help children change their thinking toward representational and symbolic thought.

Although both Piaget and Vygotsky discussed symbolic play, there are differences in each theorist's ideas about the categorizations, functions, driving forces, developmental progression, and children's mental states during symbolic play. Both believed that symbolic play included elements of representational actions, and both noted that children's symbolic play actions would progress over time (either because their cognitive abilities strengthened and this influenced their play, or because the play enhanced their ability to separate thought from action). Furthermore, even with their differences, both theorists agreed that symbolic play was an important developmental experience particularly for young children. Pellegrini and Galda (1993) noted that both Piaget and Vygotsky, "considered symbolic play to be a hallmark of the early childhood period" (p. 165). They continued:

> For both theorists symbolic play was an important venue in which young children could practice (Piaget) or learn (Vygotsky) using representational media. The symbolic play of children in middle childhood would not facilitate learning or development as it does with preschool children. (p. 165)

Whether symbolic play is evidence of children's assimilated understandings (Piaget), or the driving force for development of symbolism and later sign use and abstract thinking (Vygotsky), in both cases symbolic play can be a useful activity for preschool children as they learn and grow. Vygotsky (1976) notes that "play is not the predominant form of activity, but is, in a certain sense, the leading source of development in pre-school years" (p. 537). Thus, I chose apps with potential for symbolic play for this study because symbolic play is a mode that offers children opportunities to explore and/or demonstrate representational thinking. Further, in relation to digital apps, symbolic play is a type of play that offers possibilities for studying children's processes of playful exploration, providing potential evidence of what they already know, as well as their curiosities, interests, preferred forms of symbolic representations, and patterns of meaning making.

My study leans on these theories of symbolic play, though I tried to remain open to what I might find concerning pre-kindergarteners' choices with select touch-screen tablet applications. The applications chosen were selected because of the possibilities they offered for symbolic play, though it is symbolic play in a different space (digital rather than physical) than that observed and theorized by Piaget and Vygotsky. In particular, the types of symbolic play to be included in this study are construction play and dramatic play—two play forms that allow for exploration and representation in slightly different forms.

Play Forms: Construction and Dramatic Play Theory

As noted, symbolic play includes (among other things) the use of representation, and it can be expressed in a variety of play forms. El'Konin (2005), noted that different types of symbolization can occur during symbolic play, including a child's representational substitution of objects, activities, and self and/or others in different roles. This might occur in several forms of play, including language play, dramatic play, and construction play. As Trageton (2005) explained, theorists have developed many names and categories for different types of play that can be "roughly grouped into four play forms: a) functional play, psychomotor play, practice play, introduction play; b) role play, sociodramatic play, make believe; c) constructional play, play with materials, building play; and d) rule play" (p. 161).

These forms are similar to Piaget's (1962) original conceptions of the developmental progression of play (sensorimotor → symbolic play → construction play → sociodramatic play → games with rules). However, Trageton discussed them as different forms of play that are *not* arranged in a hierarchy of developmental progression (with the exception of sensorimotor play), but rather are equal levels of play with differing characteristics. Explaining sensorimotor play as the initial form of play that can be found in all other forms, Trageton posited that the other three play forms may begin with some form of exploratory/sensorimotor play, and then progress from lower levels to higher levels of development. For Trageton, progress from lower to higher levels of development is indicated by a movement from divergent, or more non-representational forms toward convergent or more representational forms.

Of the four play categories noted by Trageton (2005), construction play and dramatic play allow young children opportunities to use symbolic representations in different (albeit sometimes overlapping) ways. In particular, dramatic play (also called role play, sociodramatic play, make-believe, or pretend) offers opportunities for representations of roles, and is often included in early childhood classrooms as a "dramatic play" center, or "housekeeping" center, or a variety of themed sociodramatic play centers (e.g., doctor's office, store, restaurant). Construction play (also called building play, or play with materials) offers opportunities for manipulating and creating with objects. In early childhood classrooms it may take form in the block center, art center, manipulatives area, or writing center. Rule-based play is often represented in classrooms in activities such as board games, sports games, and various types of individual or group games. Of course, each form of play can contain elements of other forms. Children may build representational objects in the block center and then use the objects as part of their dramatic play (e.g., building a structure and then pretending it's a castle, with certain blocks representing castle inhabitants). In the dramatic play center, a child may pretend to "build" things (e.g., "Let's pretend that we are bakers and we have to make lots of cakes"). And as noted by Vygotsky, rules can be found in imaginary role play, and imaginary situations can be found in rule-based games.

> Just as we were able to show at the beginning that every imaginary situation contains rules in a concealed form, we have also succeeded in demonstrating the reverse—that every game with rules contains an imaginary situation in a concealed form. The development from an overt imaginary situation and covert rules to games with overt rules and a covert imaginary situation outlines the evolution of children's play from one pole to the other. (Vygotsky, 1976, p. 543)

This suggests that play categories can include overlapping features.

With such crossover between constructing and pretending, it can sometimes be difficult to make neat categorizations of construction play and dramatic play. Nevertheless, for the purposes of designing this study, I connected construction play to building or making representations with various objects (with a focus on symbolic representations of objects). I connected dramatic play to role-playing activities, with a focus of symbolic representations of roles and relationships. In vivo, the two forms of play could be admixed.

Whatever form of play children might engage in, Wolf and Grollman (1982) explained children's often differing symbolic play foci. These researchers found that some children in their study demonstrated actions the researchers interpreted as more focused on object manipulation and transformation, while other children demonstrated actions the researchers interpreted as more focused on creating narrative. They theorized that

> …symbolic play can be conducted in at least two distinguishable formats: (a) as object-independent fantasy play in which the child creates an imaginary world by inventing events, roles and props 'out of thin air' and (b) as object-dependent transformational play in which the child creates an imaginary world by aptly transforming the objects and arrangements she actually finds around her. (p. 48)

They explained these differences not as hierarchical, but rather as two possible symbolic play paths that can give evidence of both progression and development.

Wolf and Grollman cited the similarities in the theories of Piaget, Freud, Vygotsky, and Singer, stating, "Virtually every major theorist who has taken an interest in play has described it as evolving from a dependence on objects towards an increasing independence from the prompts or supports which objects provide" (p. 49). They then cited two lines of research which have examined the evolution of "object manipulation to object transformation, then to object-independent pantomime, and finally to internalized fantasy" (p. 49), and the evolution of using objects in their "prototypical form and function" to overlooking "either the form or the function of an object" to using the object to "stand in for a referent which has become both a dissimilar form and function" (p. 49-50). These two lines of research seem to separate fantasy play from object-related play, and often position fantasy play as an indicator of more advanced development. However, Wolf and Grollman emphasized that fantasy play should *not* be considered as more highly developed than object-related play, nor should object-dependent players be assumed to be unable to engage in subjective play. Nor should they be considered less sophisticated players. Issues of culture and personal interests may influence the choices children make in their object-dependent and object-independent play:

> In settings where fantasy is discouraged, more elaborate and sophisticated forms of object-related play may characterize development (Shotwell et al., 1979). Moreover, the second step of the argument overlooks the important distinction between players who are limited to objected-dependent behaviors and players who, for reasons of interest or style, elect to exercise their imaginations chiefly, but not exclusively, on the objective side of experience . (Wolf & Grollman, 1982, p. 50)

After discussing these two types or "styles" of play—fantasy and object-related—Wolf and Grollman (1982) noted that children's different styles (object-dependent versus object-independent) may be connected to their interests, and they linked object-dependent play to occur more often with "patterners" and object-independent play to occur more frequently with "dramatists". This is an important point that influenced the current study, because I did not consider one form of play as more advanced than the other. I selected apps that I believed would provide for multiple approaches for play so as to allow children with different interests the chance to engage in symbolic play in the form that is most appealing to them at any time, whether that be fantasy/pretense-related play or object-related play, or any blurring of the two lines.

Because children's open-ended exploration and actions during construction and dramatic play that occur in a digital space is yet to be fully explored, I drew from non-digital construction and dramatic play studies and findings to contextualize and guide my study. Many of the existing studies come from a teacher/researcher perspective that situates these forms of play as vehicles for learning some other concept (i.e. literacy, social skills, etc). Fewer extant studies examine children's interests and intents in their construction and dramatic play. In the next sections I explain some of the ways construction and dramatic play have been studied to date.

Non-Digital Construction Play Research

Christie and Johnson's (1987) review of studies on construction play posited that construction play "appears to be the most common form of activity during preschool and kindergarten free play periods" (p. 441). Construction play in early childhood classrooms has included a variety of activities, including painting, drawing, writing, building, molding, cutting/pasting—forms of making/manipulating objects. Research on construction play has often focused on fewer of these activities—children's block constructions or children's drawings—and with emphasis on analyzing a host of topics, including children's identity construction (Ahn & Filipenko, 2007; Hall, 2010), social navigations (Ahn & Filipenko, 2007; Hall, 2010), emergent pre-writing skills (Dyson, 1987, 1988), visual language development (Hall, 2010), communication development through first-order and second-order symbol system (Vygotsky, 1978), preferences/influences (Hall, 2010; Wohlwend, 2009a). These studies have used construction play as a medium for studying other aspects of children's development (i.e. identity, social relationships, pre-writing skills), as well as linking it to their cognitive development, perceptual abilities, and related skill development. The current project is situated to examine children's interests and experiences using construction (and dramatic) play apps.

In addition to using construction play as a medium for studying other aspects of development, children's constructions have also been examined for evidences of their developmental differences and progression over time (e.g., Caldera, Culp, O'Brien, Truglio, Alvarez, & Huston 1999; Cohen & Uhry, 2011; Kellogg 1969; Kersh, Casey, & Mercer Young, 2008; Lowenfeld & Brittain, 1964; Reifel & Greenfield, 1982). Researchers have suggested that children's constructions can indicate developmental differences in structural complexity (Kersh, Casey, & Mercer Young, 2008; Reifel & Greenfield, 1982), abilities to recreate block structures (Caldera, Culp, O'Brien, Truglio, Alvarez, & Huston 1999), and progression from non-representational structures to representational and fantasy-linked structures (Cohen & Uhry, 2011). Christie and Johnson's (1987) review of research on construction play emphasized that substantive differences in children's construction play over time included mainly qualitative changes, including more complexity in design, and more use of construction for pretense.

In these studies, indicators of "higher" development include increasing complexity of design, more representational designs, and using constructions for pretense. More recently, however, researchers have begun to posit additional indicators of development, including purposeful patterning (rather than only representational creations) (see Lambert, 2005). To complicate matters, there is also the possibility that children's differences in their construction play may be due to influences from other factors as well, including personal interests, home experiences, gender (see Christie & Johnson, 1987) or even their dispositional interests in exploring and experimenting with different modes of construction (see Lambert, 2005). The current study did not seek to delineate a hierarchy between representational and non-representational constructions, or between complex and simple structures, or between object-related and fantasy-related constructions. Instead, children's constructions were considered *not* as an indicator of developmental progression, but rather an indicator of their interests and curiosities at the moment of their engagement with particular tools.

Non-Digital Dramatic Play Research

Like studies of children's construction play, empirical dramatic play studies have used the products and processes of play to examine multiple aspects of children's lives, including their developing sociocognitive skills (Howe et al, 2005), language and literacy behaviors and skills (Neuman & Roskos, 1991, 1992; Pellegrini, 1984, 1985; Pellegrini & Galda, 1993; Williamson & Silvern, 1991), narrative development (Nicolopoulou, 1997; Pellegrini, 1984, 1985; Sachs, Goldman, & Chaille, 1985), self-identity formation (Ahn & Filipenko, 2006), communication of shared meanings (Bateson, 1955; Garvey, 1990; Howe, Petrakos, Rinaldi, & LeFebvre, 2005), and even their ability to delay gratification (Cemore & Herwig, 2005). Furthermore, play has been named/defined in a variety of ways. My search for empirical studies on dramatic play revealed a variety of terms, including: imaginative play (Ahn & Filipenko), sociodramatic play (Smilansky, 1968), pretend play (Howe, Petrakos, Rinaldi, & LeFebvre, 2005), pretense (Howe et al, 2005), and make-believe play (Cemore & Herwig, 2005).

In the studies that have focused on dramatic play and the processes of development in this type of play, researchers have discussed progress and development in terms of play persistence, communication strategies, development of roles, and theme maintenance. Howe, Petrakos, Rinaldi, and LeFebvre (2005) reviewed a theory of the progression of communication strategies used by children to maintain dramatic play, noting that "younger preschoolers rely on calls for attention, repetitions, and paralinguistic cues (e.g., play voice, sounds) to draw partners into pretense, whereas older preschoolers employ a wider variety of complex strategies (e.g., description, extending, building on)." (p. 784). Howe and her colleagues (2005) also noted the findings of Göncü that older children "included multiple dimensions of planning more than did younger children" and that "older preschoolers more successfully negotiated roles, themes and the sequence of action, notably by building on to and extending their partners ideas" (Howe et al., 2005, p. 784). At the same time, Howe, et al. (2005) referenced research that has pointed to additional factors such as ability, perspectives, interests, and understandings of the social context that can contribute to (or hinder) children's maintenance of the dramatic play frame. In their own research, Howe and her colleagues examined the processes of children (in particular, siblings) and the strategies they used as they "construct[ed] shared meanings during play" (p. 785). They found children who remained in pretend play more frequently had more shared meaning strategies (particularly describing, imitating, building on and/or extending each other's ideas) and also more often used "internal state language" (p. 791) They also found that younger children could be scaffolded to use more complex strategies if they had models to help them.

Göncü and Kessel (1998) examined young children's talk in their dramatic play and found that older children had more complexity in their play (e.g., through more complex plans) and tended to use play symbols combined in sequences more than did younger children. However, they also found that both younger (3 years) and older (4.5 years) children all used meta-communication, which included "invitations, object claims, plans, transformations, and acceptance" at the same rates (p. 340). Again, it is possible to argue that some elements of pretend play might change over time, but some might remain constant.

The findings of these studies suggest that dramatic play processes may include children's movement toward more complex communication strategies for maintaining play frames and play roles, more detailed planning for pretend play, more building on and elaboration of roles and themes, and more use of affect-related language. However, as with the construction play studies, other factors may also influence children's choices (as noted by Howe, Petrakos, Rinaldi, & LeFebvre, 2005) including children's abilities, perspective, interests, and understandings of the social context. Because these dramatic play studies occurred with children playing in physical space, they cannot specifically address whether or not digital dramatic play-related apps might allow for similar processes (e.g., means for maintaining play frames, building on/elaborating themes, more detailed planning, more affect-related language) to occur. In the current study, then, the focus was not on how children's play with dramatic-play related apps indicated developmental progression, but instead on how and whether dramatic play was a form of play in which the children were interested to engage. Because this study examined play in a digital space, the next section includes a review research on young children and technology, as well as current findings about children's interests and actions with technology.

TECHNOLOGY PLAY STUDIES WITH YOUNG CHILDREN

In Chapter One and the overview of Chapter Two, I discussed technology research in regards to the various perspectives of technology use with young children, children's home/school technology experiences (and related empirical studies), the forms of technology included (and studied) in classrooms of young children, as well as the rationale for the current study. In the following section, I review studies of children's personal interest, social interactions, and their actions and responses in digital play.

Technology Play and Children's Personal Interests

It is important to begin with the caveat that just because technology-related digital play is available, children may not necessarily choose to engage with it. McPake, Plowman, and Stephen (2010) found examples of children uninterested in technology, even though they lived in 'technology-rich' homes, surrounded by enthusiastic users of technology who were willing to assist. The researchers concluded, "It is important to recognize that even young children have agency in this context, and are not simply the artifact of their families' financial circumstances and their parents' experiences and attitudes" (p. 17). This suggests that while context does matter, it doesn't control every aspect, and children still make their own choices. For example, in her study of children's technology use, Takeuchi (2012) found her eight-year-old female participants often chose non-digital play, and preferred "real objects or people over their virtual counterparts" (p. 50). However, when they did engage in digital play, the girls used technology to create based on their interests (fashion, music, cooking). They utilized technology to play video games and virtual online games with friends and family, to keep a day planner, and to learn about cooking. These studies suggest that children's personal interests influence their technology play, and how/whether they choose to engage in it.

For those who do participate in digital play, studies have found children motivated by their personal interests (and social interests, to be explained in the next section). In a study of children's information and communication technologies at home (including computers, television, digital still and video cameras, mobile phones, electronic games and toys, and game consoles), Stephen, McPake, Plowman, and Berch-Heyman (2008) found that the children in their study took pleasure in and were interested to use various information and communication technologies when those technologies were connected to their interests, but did not like to use them if they were too difficult to manipulate, boring, too long, or beyond their comprehension. They also found that children often explained their preferences in terms of what they *enjoyed* rather than the purpose or goal a given activity might afford (p. 112).

In studies of children's home digital play, researchers have found that children's interests included opportunities to engage as active participants via a variety of play forms with fluid movement across roles. O'Mara and Laidlaw (2011) gave examples of children's home-based technology play in which they had freedom to explore, use, and create with technologies in ways that allowed them to be "deeply involved in meaning-making and in extending, exploring and expressing their own sense of self-identity as active participants in evolving technologies, and as "creators," "designers," and "experts," rather than as merely passive responders (p. 152). Marsh (2010) found that students in her study were interested in online virtual play that included various forms of play including "fantasy play, socio-dramatic play, ritualized play, games with rules, and what might be called 'rough and tumble' play" (p. 30). These children evidenced their personal interests in moving between different roles in these types of play and across different types of online games. However, even amidst play that allowed flexibility and choice, Marsh found that children also encountered situations that evoked frustration. In some cases the programs did not respond as children wanted them too, and children expressed dissatisfaction at not being able to manipulate everything in the game freely as some actions were constrained (e.g., not being able to have a character wear multiple head pieces simultaneously, such as a wig and a tiara). Wohlwend, Vander Zanden, Husbye, and Kuby (2010) also found that children's choices were sometimes hindered by the technology and software. In their study of children's participation in online social networks (Webkinz), Wohlwend and her colleagues (2010) found that children often wanted their online characters to play together, though this was thwarted by the game construction. For example, children tried many strategies to enable their online characters to bowl together, but to no avail. Thus, even while children may have some choices, and try to engage in digital play in ways that meet their personal interests, the particular technology and associated play opportunities may constrain children from making any choice they please.

Despite children's frustrations with program constraints, studies have found children can demonstrate resilience and determination, and they may persist with their own strategies even when adults suggest otherwise. For example, Davidson (2010) found that when learning to play a computer game, one child could and would learn from the game and more knowledgeable others, but sometimes ignored outside suggestions and game hints and tried to sort things out and explore on her own. Labbo (1996) found the children in her study sometimes took up suggestions made by adults, but also engaged in a variety of stances when exploring and creating with an open-ended art/word-processing computer program. At times, children took actions that indicated their interest in sorting out how the tools worked, or in creating something for themselves. At other times, they took actions indicating their interest in making jokes for and with each other, telling or directing stories with each other. The students' stances influenced their choices and actions in their digital play.

Studies have also revealed students' interests in digital play available on differing types of technology. As noted above, Stephen, McPake, Plowman, and Berch-Heyman (2008) found that the children in their study took pleasure in and were interested to use (at home) various information and communication technologies, including computers, television, digital still and video cameras, mobile phones, electronic games and toys, and game consoles, especially when connected with their interests and deemed enjoyable. Lynch and Redpath (2012) found that kindergarten students in one school said they preferred iPads to other technology resources in the classroom (iPod touches, interactive whiteboards, computers): "Most students stated that this preference was due to the 'games' available on the iPod and the iPad. These 'games' were primarily gamified literacy and numeracy apps, that is, literacy and numeracy content presented as a series of interactive tasks, the completion of which is recognized and rewarded with animated multimedia tokens of achievement (e.g., animated character moving to the sound of cheers)" (p. 10). The teacher had provided other apps as well (including interactive books, productivity apps, and generic games for free time activities) but the only ones children selected to share with researchers independently were the gamified literacy/numeracy apps, and the free-time games (i.e., a block-exploding game). Even though the teacher expected children to use the literacy and numeracy apps during literacy centers time, the students sometimes played the generic games "as part of their surreptitious play in the classroom, that is, when they were supposed to be using other apps, but took advantage of moments when they were not being observed by the teacher to play their 'favourite game'" (p. 11). These studies indicated children's preference to engage in freely chosen and often play-based activities (in both sanctioned and unsanctioned ways) whether at home or at school.

The evidence from these studies suggests that children's interests as well as opportunities for exploring, taking up different roles, using different stances, and their abilities to manipulate a given technology may all be factors influencing (along with social context) what children say and do with technology. However, their personal interests and choices cannot be removed from the social context in which they occur.

Technology Play and Children's Social Interactions

Several studies of young children's use of technology have focused on their social interactions, or at least included social interactions as one of the research foci as children used technologies. Studies have explained the ways young children collaborate and interact around co-created computer products (Chung & Walsh, 2006; Labbo, 1996), with computer games (Brooker & Siraj-Blatchford; Wang & Ching, 2003), and with various technology-related devices (Arnott, 2013). Children's social interactions around technology have been linked with children's personal interests (Genishi, 1988; Genishi & Strand, 1990) their sociocultural setting (Arnott, 2013; Eagle, 2012; Edwards, 2013; Smith, 2001; Wang & Ching, 2003; Wohlwend, 2013), the influences/affordances of the technology tool (Arnott, 2013; Ljung-Djarf, 2008; Smith, 2002; Wang & Ching, 2003), social negotiation (Arnott, 2013; Heft & Swaminathan, 2002; Wang & Ching, 2003), social positions (Ljung-Djarf, 2008), and even the interplay between "social status roles" and "technological positions" (Arnott, 2013, p. 101). Arnott (2013) noted additional influences on children's social interactions that have been studied outside of their technology-related interactions, including "peer groups and peer cultures. . . early childhood friendships. . . the social nature of children's participation. . . and childhood leadership" (p. 101). Additional social influences on children's actions and choices can also include children's and adults' differing expectations toward children's technology engagements (Davidson, 2010; Eagle, 2012; McPake, Plowman, & Stephen, 2010; Takeuchi, 2012) and how this might influence children's choices. For example, McPake, Plowman, and Stephen (2010) found children chose to learn skills to play games and use technology in ways of interest to them (even at young ages), but that family attitudes and access toward technology engagement sometimes influenced children's skill levels. Children who were given freedom to explore and try new things that were of interest to them were able to develop the necessary skills needed for the activity, either through sorting it out collectively (Wang & Ching, 2003), following the directive leadership of others (Arnott, 2013) or requesting/receiving help from more knowledgeable others (Arnott, 2013; Davidson, 2010; Genishi, 1988, 1989; Verenikina & Kervin, 2011).

However, researchers also found even with the social influences and supports, children do not *always* follow the lead of more knowledgeable others (Wang & Ching, 2003). Studies have included examples of children making decisions and taking actions around their own interests (Genishi, 1989, 1990; Labbo, 1996; Marsh, 2010; Takeuchi, 2012; Verenikina & Kervin, 2011; Wohlwend, 2009). Wang and Ching (2003) found that students' computer game play was influenced by a combination of *both* individual and social goals. Individual goals included "game playing goals" in which the students were involved in "playing the game for as long as possible and getting to the highest level" (p. 348) and social goals such as "socially belonging to the group, having fun with friends, and forming and consolidating friendships" (p. 348).

In the current study, I examined the ways children chose to communicate and interact, and the perceived personal and social influences on their perspectives and actions. Across the cited studies, children's preferences and interests were indicated not only by what they said, but also by their actions.

Children's Play Actions When Using Technology

Closely linked with children's personal interests and social influences are the actions they take while interacting and exploring with technology. Those actions may involve exploration through which they seek playful activities, and practice after finding them. For example, children have engaged in play-related actions during interactive book explorations, (particularly computer-based CD-rom books), by seeking to activate hotspots and animations (De Jong & Bus, 2004; James, 1999). In their study of children's engagement with interactive digital stories, De Jong and Bus (2004) found that students activated more animations on each page in later explorations than in earlier ones. James (1999) found that the two youngest children in his study (ages four and six) learned to navigate through the pages very quickly, and became increasingly engaged in finding the 'hotspots' on a given page and then activating them repeatedly. The children's actions indicated their play-related interests in finding these hotspots and animations, and they quickly learned the required procedures for activating these playful program features.

Although studies such as those of De Jong and Bus (2004) and James (1999) provided evidence of children's abilities to learn quickly the necessary actions for participating in digital play opportunities, other studies have found that in some situations, children may need some guidance to help them navigate through digital play. Verenikina and Kervin (2011) found that while some children in their study preferred creative activity applications, such as those that allow for puppet show creations, the children were not always able to fully manipulate the programs. The researchers discovered that some children occasionally needed assistance with learning how to use the program, and parents often demonstrated and/or monitored play (sometimes even only for a few seconds) during the children's early attempts with a particular application. Once children figured out a workable solution, they quickly used it and their skills evolved. As an example, the researchers shared a case in which one three-year-old girl, using a puppet show creation application, first engaged in repeatedly watching some of the puppet shows her father and sister had created. Over time she began making her own puppet shows, choosing backdrops, recording the show, and eventually was able to move her characters while recording. She sought help as needed from her mother or her older sister to acquire the necessary technical skills, and eventually created puppet shows on her own.

Some research has examined how children took up tablet play on their own. Couse and Chen (2010) examined children's acclimation to and use of stylus-interfaced drawing with a touch-screen tablet-drawing app. In their study, they examined children's tablet acclimation, the nature of their tablet engagement, as well as teacher perceptions of children's interests. The researchers examined and coded students' actions into three levels of tablet use:

> Level 1—Explore/experiment: Child tries to figure out what the tablet can do, clicking with the stylus pen on different options to see what will happen if…
>
> Level 2—Investigate: Child tries to figure out how to use the tablet to create a desired effect (e.g., How can I get this color? What do I need to do to make a thick, translucent/highlighter line?)
>
> Level 3—Create: Child produces desired effects in drawing even if the drawing is not a realistic representation of real life objects that have been described. The child is content with, and is clear about what is being drawn. (p. 87)

Couse and Chen (2010) organized these levels hierarchically and measured the percentage of children who reached the “highest” level (Level 3) within each session. Their findings revealed:

> At the introductory session in Phase 1, 31 (75.6%) children reached the highest level (Create), and 10 children (24.4%) reached the second level (Investigate), in which they tried to figure out how to produce desired effects in their drawings. By the Phase 2 session, most children (98%) had reached the highest level, with only one child (2%) still operating at the Investigation level. (p 89)

These categorizations—creation and investigation—were considered in the current study, as were measurements of the amounts of time students spent engaged with the available apps. This study differs, however, in that it does not ascribe hierarchical levels of children’s engagement.

In addition to learning how to navigate through digital play, studies have also found that children’s play may mix digital and non-digital aspects. For example, students have created technology props to use in their non-digital play, including technology devices for their dolls (O’Mara & Laidlaw, 2011), or paper cell phones and iPods for their dramatic play (Wohlwend, 2009). Other children incorporated technology actions into their non-digital play, such as playing video games with only paper and markers (Wohlwend 2009b, 2010), or taking ideas, digital characters, and game actions into their outdoor pretend play (Dorst cited in McMahon, Lytle, & Sutton-Smith, 2005; Verenikina & Kervin, 2011). Smith’s (2002) study revealed the mixing of digital and non-digital play by one toddler who took hyper-text experiences into his real-world situations. After play with a CD-ROM computer game, this child created his own game in which he asked his parents, “Click on me” and then responded with silly actions when “clicked”. The child also invented a CD-ROM game that involved the use of a mirror as a ‘screen’ and different rooms as different pages of an interactive text. Similarly, Dorst cited in

McMahon, Lytle, and Sutton-Smith (2005) found that a group of boys adapted the characters and some actions from a Nintendo video game (Super Mario Brothers) into their outdoor recess play. They even put themselves on "pause" when they needed to stop the action momentarily. Sometimes, children even blended digital play and non-digital play in the same setting, such as the children in O'Mara and Laidlaw's (2011) study who situated their iPad with Toca Tea Party in the middle of the floor, surrounded by their stuffed toys and a physical tea set:

> The transformation of objects inside the dramatic play seamlessly shifts from the virtual to the physical, the cups of tea being served, drunk and spilled in the virtual iPad space extending over into the pouring of 'cups of tea' served from the teapot into the plastic tea set on the other side of the picnic basket. The boundaries between 'physical' and 'virtual' blur, with all play objects – the iPad, stuffed toys, plastic tea-set – crossing into the realm of imagination and the narrative structures of dramatic playing inside a virtual world. (p. 150)

These examples indicate that the lines between children's digital and non-digital play experiences are sometimes blurred. Furthermore, students' actions in digital play seem to be influenced by several factors, including program affordances, player skill level, available helpful resources, and children's own interests in engaging in technology-related play—be it digital, non-digital, or some hybrid of the two. In these instances, children have agency to make choices, although they do so within a sociocultural setting with a particular context, so that "activities vary depending upon the make-up of the individuals, the setting, and the cultural and temporal context" (Arnott, 2013, p. 100).

Classroom Context

In addition to examining students' interests, actions, and social interactions in their digital play, this study also included consideration of the context in which students' choices were situated. The classroom itself offers a cultural context that can be examined (Rogoff, 1998). Every classroom is situated within a larger macro-level cultural context

(Bennett & Le Compte, 1990), and many play studies have looked at macro-level cultural influences on children's play (e.g., Edwards, 2000; Fleer, Tonyan, Mantilla, & Rivalland, 2009; Pramling-Samuelsson & Fleer, 2009; Roopnarine, Lasker, Sacks, & Stores, 1998; Taylor, Rogers, Dodd, Kaneda, Nagasaki, Watanabe, & Goshiki, 2004; Taylor, Samuelsson, & Rogers, 2010; Tobin, Hsueh, Karasawa, & Mayumi, 2009; Tudge, 2008). This study, however, did not include data collection/examination of the larger macro-level cultural forces. Because of access and permission-related time constraints, this study examined only one classroom culture as arranged and organized by one teacher.

Much of the research on young children's digital play experiences has centered around home-based play (Davidson, 2010; Eagle, 2012; Marsh, 2010; McPake, Plowman, & Stephen, 2010; O'Mara & Laidlaw, 2011; Stephen, McPake, Plowman, & Berch-Heyman, 2008; Takeuchi, 2012) or school play that occurred outside of a traditional classroom context, such as an after-school club (Wohlwend, Vander Zanden, Husbye, & Kuby, 2010). However, play researchers have suggested the ways in which the classroom environment can afford unique opportunities for play (Reifel, Hoke, Pape & Wisneski, 2004). In this unique environment of classroom-related play, researchers have noted the importance of considering a variety of contextual features, including "materials, social relations, real-world experience, play decisions, and time" (Reifel & Yeatman, 1993, p. 355). Furthermore, researchers have found teachers' beliefs about play can be uniquely interwoven with their practice (Bennett, Wood, & Rogers, 1997; Moon & Reifel, 2008), and can be connected with the types of play-related activities they provide for students (Moon & Reifel, 2008). In this study, I examined the teacher's beliefs about and provision for play opportunities in the classroom, so as to understand the context of children's classroom-based digital play choices.

Concerning digital play opportunities, researchers have also found a teacher's beliefs about technology can be connected with the types of digital play opportunities he or she provides for students. Ljung-Djärf, Åberg-Bengtsson, and Ottosson (2005) offered three possible teacher attitudes and related environmental organization for digital play: 1) as a threat to other activities, 2) as an available option, or 3) as an essential activity. The "threat" category is defined as a perspective that "computers are important *but* should not be given a high priority, as the children need exposure to other activities more" (p. 33). The "available option" approach includes teachers' beliefs and supports of children's engagement with technology according to their interests, as well as adult support and encouragement of children's helping one another, and a perception of computer knowledge as shared knowledge. Finally, the "essential activity" beliefs include as its main characteristic the perception that "the computer is important and that all children should be encouraged and included in using it. Equality and justice, that is, the same opportunities for everyone, are the focus" (p. 35). These possible perspectives of the teacher towards digital play opportunities were considered in the current study as well.

Associated with the classroom culture and the teacher's beliefs, the organization of the classroom and even the computer area can be connected with students' choices and interests. Existing studies on children's digital play in classrooms have examined individual students (Escobedo, 1992, 1999; Labbo, 1996) or groups of students sharing single computers (Arnott, 2013; Brooker & Siraj-Blatchford, 2002; Ljung-Djärf, 2008), or parallel computers that were differently prepared with few open-ended apps (Heft & Swaminathan, 2002; Wang & Ching, 2003). In the current study, I examined parallel tablets that were identically prepared, situated in an activity center which pairs of students visited together.

Socioculturally Situating An Examination of Children's Play With Open Ended iPad Apps

This study's examination of children's play with open-ended iPad apps was designed to learn more about children's symbolic play, particularly their interests, actions, and interactions within a particular sociocultural setting—the classroom—and in the presence of a new technological tool—a touch-screen tablet. Although this study was neither an examination of macro-level cultural influences, nor an ethnography of classroom culture or students' home cultural influences, I took care to situate the study within its sociocultural context. I subscribed to several strategies to consider the sociocultural context and to avoid culturally hegemonic definitions and analyses of children's play. These strategies included: 1) a review of literature that presents multiple definitions of play; 2) a broad definition of play for the current study; 3) an inclusion of literature that includes challenges to traditional linear, hierarchical play-development perspectives; 4) an explanation (to be shared below) of the play and cultural perspectives influencing this study, 5) and the selection of grounded theory methodology for the purposes of developing theory and comparing it to existing play theory rather than exclusively matching the data to a pre-determined theoretical framework. I explain each of these five strategies in turn.

Multiple Definitions of Play

As described earlier, I reviewed the construction of "play" across fields (e.g., anthropology, sociology, education, psychology), and specifically noted the foci of educational play research on different developmental domains (e.g., social, emotional, cognitive, and physical domains). I also included reference to non-developmental aspects of play (e.g., play to expend energy, relax, express ourselves), as well as play research that has considered specific elements of human experience such as communication, cultural influences, and gendered perspectives. I included a review of Sutton-Smith's (1997) play rhetorics, noting that my own study accedes to a "play as progress" rhetoric, but also leaves space for the possibilities of additional rhetorics in which children's actions and choices might exemplify play (perhaps differently from play as defined by a "progress" rhetoric) depending on their goals, orientations, and dispositions. I assert that the players themselves know when they are playing, and thus I selected a broad definition of play that I hoped would allow students' own perspectives and interests to emerge as I analyzed the data.

Broad Definition of Play for this Study

The broad definition of play that I selected for this study allowed my construct of play to include multiple characteristics associated with *disposition*, *observable behavior,* and *context*, as noted Rubin, Fein, and Vandeberg's 1983 review. Recall these authors' explanation of the six features of play connected with the dispositional category: intrinsic motivation, attention to means rather than ends, organism dominated, non-literal and simulative behavior, freedom from externally imposed rules, and active engagement (p. 698-699). In my study, I organized opportunities for play from a "play as disposition" perspective by making a classroom iPad station available to interested students during free-choice center time. At the iPad station, children could freely and with few externally imposed rules actively interact with a variety of open-ended iPad apps. They could engage in non-literality in ways of interest and purpose to them.

Rubin and his colleagues described the "play as context" category as including a variety of materials, children's ability to freely choose activities, minimal intrusion or direction from adults, a comfortable atmosphere, and occurring during a time when children are not likely to be "tired, hungry, ill, or experiencing other types of bodily stress" (p. 701). In this study, opportunities for "play as context" were available via the provision of interesting materials (iPads and open-ended iPad apps), the arrangement for children's choice whether visit the iPad station and engage with desired apps (or not), and minimal adult direction.

Finally, Rubin and his colleagues' (1983) "play as observable behavior" category included "taxonomies of behavior in which are described distinctive types of play" (p. 700). As previously discussed, although I kept existing taxonomies of play in mind, I tried to remain open to the ways in which children's digital play choices and actions might indicate types of play not previously discussed by canon theorists. Even so, I designed the study to include apps that might allow for various types of symbolic play, including construction play and dramatic play.

Even with a broader definition of what might count as play, and one that I hoped would allow for students' own interests to remain at the center of the inquiry, I had to situate my study within the existing landscape of non-digital construction and dramatic play (due to the understudied nature of digital versions of these two types of play), and the emerging landscape of young children's digital play studies. My review of these studies included findings on students' developmental trajectories, as well as challenges to the notion of linear, hierarchical play development.

Challenges to Linear, Hierarchical Play Development

Another strategy I used to consider the sociocultural contexts of children's play, and to avoid imposing hegemonic dominant perspectives on a "new" context, was my review and inclusion of study findings that challenge the "linearity, universal human behavior, unidirectional progress and standards of normalcy" (Cannella, 2002, p. 124). The review of literature thus far has discussed the blurring of lines between play and exploration, between the many forms/categories of play, and between digital and non-digital play. For example, I pointed toward the study by Wolf and Grollman (1982) as a foundation for analysis that allows fantasy play and object-related play to be positioned equally so that one form is not considered more advanced than the other. Wolf and Grollman emphasized that fantasy play should *not* be considered as more highly developed than object-related play, nor should object-dependent players be assumed to be unable to engage in subjective play or considered less sophisticated players. As with all play episodes, issues of culture and personal interests may influence the choices children make in their object-dependent and object-independent play.

I also questioned into assumptions on studies positing "higher" development based on complexity of design, and on using construction for pretense. I argued for avoiding a hierarchy between representational and non-representational constructions, or between complex and simple structures, or between object-related and fantasy-related constructions. I presented literature positing non-representational designs (e.g., purposeful patterning) as indicators of development (Lambert, 2005). I then offered more complexity by crediting researchers who have posed other factors connected to play differences, including children's personal interests, home experiences, gender (see Christie & Johnson, 1987), or even their dispositional interests in exploring and experimenting with different modes of construction (see Lambert, 2005). I used these studies to guide analysis so that children's constructions were considered not as an indicator of developmental progression, but rather an indicator of their interests and curiosities at the moment of their engagement.

Finally, concerning the studies on children's technology-related play, I reviewed research that positioned children as active agents in their digital play (Davidson, 2010; McPake, Plowman, & Stephen, 2010; Takeuchi, 2012; Wang & Ching, 2003), as players who made choices based on their interests (Genishi, 1989, 1990; Labbo, 1996; McPake, Plowman, & Stephen, 2010; Stephen, McPake, Plowman, & Berch-Heyman, 2008; Takeuchi, 2012), and who participated in a variety of types of digital play (Marsh, 2010; O'Mara & Laidlaw, 2011). Although I included research on children's hierarchical levels of tablet engagement (Couse & Chen, 2010), I did so with the caveat that such hierarchies might not be present across contexts, or might be connected with other factors as indicated in the studies previously discussed on non-digital construction play. These studies and perspectives were selected to guide my analyses toward staying open and alert to the richness of children's actions. Through close and critical inspection of extant research, I sought to avoid imposing culturally monolithic perspectives that might assume "linearity, universal human behavior, unidirectional progress and standards of normalcy" (Cannella, 2002, p. 124) in children's digital play.

By including these studies, and by selecting a methodology (classic grounded theory) that allowed me to examine students' interests as they occurred *in situ*, rather than as they aligned with an existing theoretical framework, I worked to maintain additive views of the teacher and students so as to be open to a careful and nuanced understanding of the multiple influences informing children's play, in efforts to avoid a color-blind, normed, dominant-perspective, essentialized interpretation of children's play (Cannella, 2002; Fleer, 1999; Pramling-Samuelsson & Fleer, 2008; Roopnarine, Lasker, Sacks, & Stores, 1998; Soto, 2000).

Play & Culture Theoretical Influences

My study was designed to be open to many possible actions that might count as play. Thus, while the students in the focus classroom come from many different cultural and socioeconomic backgrounds, their actions and choices could indicate play when connected to their interests and perspectives, even if not conforming to traditional canonized perspectives of play. Children's choices and actions may demonstrate similarities and differences across their play as well as differences across play contexts. I positioned my inquiry with a cultural perspective of play that acknowledges the broad variety of actions deemed as 'play,' and positions children as active agents who both respond to and interpret their sociocultural setting. Tudge's (2008) study of young children's lives in multiple rural and urban cultures in seven countries (Brazil, Estonia, Finland, Kenya, Russia, South Korea, and the United States) revealed there was "relative similarity across all groups in the extent of both availability of and engagement in play" (p. 142). He found the children throughout his study engaged in eight types of play: "playing with toys. . . playing with natural objects. . . playing with no objects . . . playing with objects that were not designed specifically with children in mind. . . pretend play. . . playing with academic objects . . . watching television, and engaging in other types of entertainment" (p. 149). Differences in children's play across groups included the objects children played with, as well as social class differences in the amount of time spent in certain types of play, although Tudge noted that "social class differences within a city (Suwon children playing with academic objects for example) were sometimes far greater than differences across cities" (p. 157). For Tudge, many activities were deemed to be play, and he also witnessed children actively involved with and changing their own settings, indicating that "sometimes children are more 'interpretive' than 'reproductive' of cultural norms" (p. 157).

In this study, I observed individuals' actions as they occurred within the same sociocultural setting: a pre-kindergarten classroom. The setting also included access to the same material: touch-screen tablets prepared with open-ended apps. Therefore, students' choices and actions were understood as situated within this classroom-based sociocultural setting. Arnott (2013) noted that in her study, "the interplay between the technology and children as active agents" had "shaped the situated encounters and interactions observed" (p. 101). So too did this interplay between the child as active agent and the affordances of the tool shape the encounters and interactions of the students in the current study.

It is important to note that, in addition to the classroom culture influencing students' choices, students' home cultures were also understood as possible influences. However, because of limitations of access, children's home culture was not a topic of focus in the current study. This is acknowledged as a limitation rather than as an undervaluing of children's incoming funds of knowledge (Moll, Amanti, Neff, & Gonzalez, 1992). Aspects of culture examined in this study included only the visible classroom and peer influences. At the individual-in-the-classroom level, any possible differences in students' choices were considered from the "repertoires of practice" perspective of Gutierréz & Rogoff (2003). From this perspective, students' cultural "variations reside not as traits of individuals or collections of individuals, but as proclivities of people with certain histories of engagement with specific cultural activities. Thus, individuals' and groups' experiences in activities—not their traits—becomes the focus" (p. 19). In the current study, focus remained on individuals' and groups' experiences in activities within the classroom. In seeking to carefully document these activities without overgeneralizing, I took up Gutiérrez & Rogoff's (2003) suggestions for researchers seeking to "focus on understanding developing individuals and changing communities, making first guesses about patterns and seeking confirmation or disconfirmation to extend what is known" (p. 23). This included my use of past tense in my write-up of students' choices, "Using the past tense marks the findings as statements of what was observed rather than too quickly assuming a timeless truth to what is always a situated observations" (p. 23). I also used demographic information "not as categories but as narrative descriptors of the participants' backgrounds" in order to not "imply an essence of the individual or group involved" and so that such descriptors would not be "treated as causal entities" (p. 23). I also worked to "avoid over-generalizing" so that my goal could be to "ground observations across multiple settings . . . and to assume various vantage points to understand the complexity of human activity" (p. 23). My examination in one classroom is a first step toward "ground[ing] observations across multiple settings." In order to consider students' play choices in one classroom, I selected a grounded theory methodology.

Grounded Theory for Openness Toward Children's Play Interests

To consider fully the players' multiple perspectives, interests, choices, and experiences in the classroom context, I chose to design this study according to classic grounded theory perspectives (Glaser 1998; Glaser, 2001; Glaser & Strauss, 1967). As noted by Erikson (1972), there could be multiple ways to interpret even a single recorded sequence of play. Trageton (2005) also noted that when analyzing the play of young children, one "may have to use a variety of these definitions to realize and describe what is going on" (p. 161). I attempted to bracket and put to the side my developing view of play during data collection and beginning analysis, but later returned to the literature for comparison with what emerged from the data. Through the grounded theory approach to this study, I tried to interpret—as much as possible—children's own meanings around their play.

Grounded Theory with Qualitative Data

In the studies reviewed throughout this chapter, while information emerged from the data on children's interests and preferences around various types of technology (usually computer) use, as well as their actions and speech acts, in most cases the researcher arrayed new data into existing theoretical frameworks. These frameworks included issues of identity (Marsh, 2010), gender (Takeuchi, 2012), cultural influences (Takeuchi, 2012; McPake, Plowman, & Stephen, 2010), nexus analysis of typical practices of sense-making and discourse (Wohlwend, Vander Zanden, Husbye, & Kuby, 2011), semiotic analysis of children's stances and symbolic modes (Labbo, 1996), social status and technological positions (Arnott, 2013) or multiple frameworks (Takeuchi, 2012; Wohlwend et al, 2011). Other studies focused more on thick and rich description of children's actions and how they seemed to learn to navigate and make sense of things in digital (usually computer) play (e.g., Davidson, 2010). In one study, Wang and Ching (2003) used a grounded theory approach to develop a model of children's social processes and mediational technological artifacts. However, I found no studies applying grounded theory approach to gather and interpret children's perspectives, actions, and use and as they interacted with open-ended apps in a digital space. Thus, this research examined children's perspectives, exploration, and play in a digital space, as well as their actual use and manipulation of technology via touch-screen tablet applications. It has attempted to inform how one group of children within a specifically situated sociocultural contextualized experience took up digital activities for their own purposes. Through the findings, a model of children's socially situated digital play was developed.

I used a classic grounded theory approach combined with qualitative data sources to examine children's processes as well as their interests and meaning making when encountering, exploring, and creating with open-ended iPad applications. It is important to note that I interpreted grounded theory not as a method of qualitative data analysis, but instead, as classical grounded theory as explained by Glaser (1978; 1992; 1998). This is an inductive reasoning approach that can be used with quantitative or qualitative data, and should include strategies for a flexible and modifiable design so that as data is collected, theory can be generated as it arises from constant comparative analyses.

For this study, I used the general methodology of classic grounded theory with qualitative data. According to Denzin and Lincoln (2005), "qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them" (p. 3). Qualitative data collection measures allow for examination of multiple contextual influences such as objects, social interactions, time, previous experiences, and interests of children as they play and explore with tablet touch-screen applications. In this study I collected data from a variety of sources toward achieving a more complex and contextualized (Mertens, 1998) understanding of young children's playful exploration and creation with various application software on iPads. Furthermore, the use of grounded theory approach allowed me to examine children's main concerns as they encountered and worked with these applications, as evidenced through their actions, interactions, talk, gestures, and creations.

Through close examination of children's talk, actions, gestures, interactions, creations, and the related contextual influences in which all their activity is situated, I gathered and compared data that allowed a multimodal perspective (Flewitt, 2006) of children's interests and approaches, as well as for emergent theory around children's processes and their related interests in the presence of iPad apps pre-scelected for their open-ended features. The initial foray into analysis began with the expectation that at the outset, I could not know what might emerge from the data as key processes and children's main concerns (Glaser, 1978, 1992, 1998; Glaser & Strauss, 1967). However, a classic grounded theory approach allows for this type of emergence. It is an approach that is a useful fit for an exploratory study in the substantive area of play. To reiterate, the research questions that guide this study were as follows:

1. In what ways do preschool children interact and engage with open-ended, symbolic-play related applications as indicated through their talk, actions, and interactions?

2. How does the classroom context seem related to the children's decisions, actions, and engagement with open-ended apps?

In addition to being guided by my research questions, I also worked to follow Glaser's (2001) call to include strategies for "retaining the flexibility to allow the unanticipated to emerge" (p. 114). I maintained a dissertation journal to track those emergences. Furthermore, it is important to note that the focus of this study was not to merely describe what happened—it is not solely a descriptive study (though description is included). Instead, my goal was to develop theory of the basic social processes. Through the use of constant comparative analysis, systematic coding procedures (open, selective, and theoretical), continual interaction with the data, theoretical sampling, and conceptualization of latent patterns, theoretical formulation occurs and theory was generated from the data (Glaser & Strauss, 1967; Glaser 1978, 1992, 1998, 2001). In addition to presenting the generated theory, the following chapters also provide specific information on how this conceptual development and theory emerged through the various stages of coding and interacting with the participants, data, and developing concepts.

In keeping with the classic grounded theory approach, my coding and analysis began simultaneously with data collection. As I reviewed the data, I watched for and developed patterns, codes, and categories emerging from the data itself rather than from pre-existing theory. Creswell (1998) explained that a grounded theory researcher should use (existing) theory at the end of a study, and explains that in his own grounded theory studies, "I have refrained from advancing a theory at the beginning of my grounded theory research, generated the theory through data collection and analysis, posed the theory as a logic diagram, and introduced contending and contrasting theories with the model I generate at the end of my study." (p. 86) In the current study I followed the same approach, simultaneously collecting and analyzing data in order to discover the participants' main concerns, and then developing hypotheses grounded in the constant comparative analysis of the data.

The theory that emerges from any grounded theory approach should not be forced, but allowed to emerge from the data. As Glaser (1998) contended, "Grounded theory is the discovery of what is there and emerges. It is *not* invented" (p. 4). For grounded theory one needs multiple data points, and the ability to compare data from many different participants (Glaser & Strauss, 1967). The researcher's job in grounded theory "is not to provide a perfect description of an area, but to develop a theory that accounts for much of the relevant behavior" (Glaser & Strauss, 1967, p. 30). In the next chapter I describe the participants, procedures, measures, and data collection and analysis processes I used to develop a grounded theory of children's play within a digital space.

Chapter 3: Methods

The purpose of this study was to develop a greater understanding of children's approaches and interests as they played in and around digital space afforded by open-ended applications on a touch-screen tablet. Touch-screen tablets were selected and equipped with applications that afforded children in one public school pre-kindergarten classroom opportunities to interact and explore possibly via symbolic play—particularly construction and dramatic play. Because this was an exploratory study, guided by a classic grounded theory approach, the procedures and original research questions were planned and written with the understanding that the grounded theory data collection and analysis process might result in shifting of procedures and research questions due to the data-based emergence of key processes. From a Glaserian grounded theory approach, a researcher should include strategies for "retaining the flexibility to allow the unanticipated to emerge" (Glaser, 2001, p. 114). In order to make clear the carefully planned procedures and the process of data collection and analysis guided by flexible response, in this chapter I explain the questions and methods guiding the study, followed by descriptions of the setting, procedures, data sources and management, as well as issues of credibility. I end the chapter with detailed information about my initial steps in data analyses, and how the weekly data analysis guided and altered slightly the procedures and analysis.

SETTING

State

This study took place in a large southwestern state. In this state, free public pre-kindergarten is only available to those students deemed "at risk," as delineated by the following categories: limited English proficiency; limited family income; homelessness;

child of an active duty military parent or parent who was killed while serving in the military; or having been at some point under conservatorship of the Department of Family and Protective Services (see the Texas Education Code, Chapter 29, Subchapter E, Section 29.153). The pre-kindergarten programs follow state guidelines and district curriculum that intends to promote school readiness by focusing on children's development in several domains, including social and emotional, language and communication, emergent literacy (including reading and writing); mathematics, science, social studies, fine arts, physical development, and technology.

While this state program aims to help "at-risk" children, the very notion of "at-risk" perpetrates a deficit-view of the children who attend the public pre-kindergarten. It is a positioning that might influence even the most well-intentioned teachers and thus, their classrooms. It is a macro-level contextual feature that likely plays a role in children's public pre-kindergarten classroom experiences, but which was beyond the scope of this study. Even so, I worked to maintain additive views of the teacher and students, so as to be open to a careful and nuanced understanding of the multiple influences informing children's play, in efforts to avoid a normed, dominant-perspective, essentialized interpretation of children's play (Cannella, 2002; Fleer, 1999; Pramling-Samuelsson & Fleer, 2008; Roopnarine, Lasker, Sacks, & Stores, 1998; Soto, 2000).

City & School District

During the year of this study, the school district in this city served approximately 86,000 students, over 55,000 of whom were economically disadvantaged, and 24,000 of whom were identified as "Limited English Proficient" as determined by state testing. The district was situated within a large, metropolitan city of over 800,000 residents. The most recent public state data report (2011-2012) showed that the district served a total of

11 pre-kindergarten military students, and a total of 12 pre-kindergarten foster children. The remainder of pre-kindergarten students (over 5,200) gained admission based on family income, homeless status, or demonstration of limited English proficiency (as indicated through state testing). The district was chosen because of its accessibility to the researcher in terms of budget and travel, administrative approval, and the teacher's willingness to participate in the study.

School

The state academic performance report for the year of this research project indicated that the school for this study served approximately 900 students, 6.1% of whom were classified as economically disadvantaged. Just over 27% of the student population was classified as "at risk," and 11% were classified as English Language Learners. The ethnic distribution reported to the state indicated approximately 56% were White, 24% Latino, 12% Asian, 2% African American, and just over 5% of students identified with two or more races (citation withheld to maintain school anonymity). During the time of the study, the school had two pre-kindergarten classes serving 46 students. I selected the school by acquiring district permission to contact three principals, and initially contacted one of those administrators. This first-contacted principal replied to my initial email invitation, granted access to her campus for research and allowed me to contact the preschool teachers about whether or not they would be interested in participating in the study. A subsequent email invitation to the teachers revealed that the early childhood teachers were interested in the proposed study, with one teacher in particular—Ms. Murray—indicating a strong interest in participation. The other teacher said she would participate if needed, but as a new teacher she preferred to use her time to focus on her own practice.

Classroom / Teacher

The classroom in this study included one European American teacher with 20 years of experience teaching, with 18 of those years teaching pre-kindergarten. Of the two teachers in this particular school, this teacher—Ms. Murray (a pseudonym)—indicated a high level of interest in participating in the study, and had participated in earlier university-sponsored classroom-based research. Because she had just acquired two iPads for her classroom, she shared her interest in learning more about how students might use them. She indicated willingness to allow me to work with students in her classroom, and to set up an iPad station as one of the center selections available during students' regular free-choice center time. In this classroom each day, students had an extended amount of time for free-choice, open-ended exploration and play, and there were a variety of available choices, including centers for math, literacy, art, science, library, puzzles, blocks, puppets, and dramatic play.

Students

During the study, there were a total of 18 students (6 boys and 12 girls) enrolled in the selected class. District policy and permission to conduct the study did not permit me to ask the teacher about individual students' socioeconomic status, home language status, or ethnicity. The teacher was allowed to inform me that more than half of her students qualified for free enrollment based on income and/or language requirements. In previous years, *all* pre-kindergarten students at this school were admitted to the program via state requirements for "at risk" admission qualifications. However, in the year of this study, according to the principal, several students were admitted via a fee-paying program instituted by the district for parents whose children do not qualify for the free public-pre-kindergarten program. In this school and others around the district, a handful of spaces were available for these fee-paying students. Publicly available reports from the state education agency show that demographics for the entire group of prekindergarten students (n=46) during the beginning-of-year snapshot were as follows: 39% Latino, 28% White, and 17% Asian. The focus-class teacher confirmed that the current group of students was similar in demographic statistics to those in previous years. Furthermore, over the course of the study, several parents shared with the researcher their family's culture of origin, thus revealing a culturally diverse group of students. The children in this study were all between the ages of four and five years.

Because this study inquired into young children's explorations and play using a digital tool, pre-kindergarten students were purposely selected (Patton, 2002). By the age of four to five years, children have often developed sufficient precision in fine motor skills to manipulate touch-screen tablets, can represent ideas symbolically (Piaget 1962, Vygotsky 1976), engage in dramatic and constructive play (Piaget, 1962; Smilansky, 1968), and demonstrate evidence of the emergence of literacy (Sulzby, 1985). All these abilities are important as they can be connected to children's abilities to navigate iPad apps even when they cannot yet read text conventionally. Furthermore, as noted by many early childhood educators (e.g., Bodrova & Leong, 2007; Copple & Bredekamp, 2009; NAEYC, 2009; n.d.) symbolic play (including dramatic and construction play) is a leading activity for development during the pre-kindergarten and kindergarten years. Variations in development and expression among children of the same age can occur for a variety of reasons (Copple & Bredekamp, 2009; Frost, Wortham, & Reifel, 2012), and I was careful to consider multiple perspectives on "development" so as not to form deficit views of students (Cannella, 2002; Ladson-Billings, 1994). My consideration of variations in children's experiences and expressions of self allowed me to consider the already-present literacies and funds of knowledge (Moll, Amanti, Neff, & Gonzalez, 1992) children brought with them to school. Inclusion of variation in experience was also important for developing grounded theory in which a wider variety of sampling offered the possibility for more complex conceptual and theory development (Glaser & Strauss, 1967). The children in the study had a range of technology experiences, with some students' parents reporting their having access to multiple forms of technology at home (e.g., computers, electronic toys, touch-screen devices) and others having access to only a few forms (e.g., televisions, cell phones, music players). They also reported varied levels of interest in technology related play.

Researcher Experiences

I identify as a European American female teacher, with former public/private elementary school teaching experience (16 years total: 10 years teaching elementary music, 2 years teaching kindergarten, 1 year teaching fourth grade, 1 year teaching Head Start, and 2 years serving as librarian/instructional technology specialist in a public pre-kindergarten). During my two years as librarian/instructional technology specialist at a public pre-kindergarten, I worked with both teachers and students to integrate technology in the classroom curriculum. Through this experience I had multiple opportunities to guide children through interactions with various forms of technology, including computer hardware/software, internet, whiteboards, digital photography, and sound projection devices.

In addition to my professional experiences with instructional technology in education, I have life experience using technology, especially computers, at home. In the 1970s my father became interested in personal computers and taught himself computer programming, and in 1977 he purchased the first of many family computers, a Commodore PET 2001. Soon after, he purchased additional computers, and this first family computer was moved into my room. Thus, from a young age, I have been engaged with computing and computer education in my personal life. This has influenced my comfort levels and interest in integrating technology into my educator life.

In addition to my technology and teaching background, prior knowledge and experiences around the concept of "play" has also influenced my work – including my teaching and researching about children's play (and adult perceptions and beliefs). For over eight semesters I worked as a teaching assistant for an undergraduate class on play and early development, and have read and taught about many perspectives on observing, theorizing, and analyzing children's play from multiple perspectives (Frost, Wortham, & Reifel, 2012). In addition, I studied teachers' (pre-service and in-service) beliefs and perspectives about play, parents' perspectives on play, and conducted a small study on undergraduate students' perceptions and beliefs about play over time.

Furthermore, my thinking in regards to the careful interpretation of the possible cultural, linguistic, gender, socioeconomic differences revealed in children's play have been influenced by my reading and earlier research projects on multicultural education (Banks, 2004; Nieto, 2008; Sleeter & Grant, 2003) and culturally responsive practice (Ladson-Billings, 1995; Villegas & Lucas, 2002). My teaching experiences, reading, research, and personal belief system influence my desire to carefully consider multiple perspectives when interpreting children's play in order to maintain additive perspectives on children's language, culture, gender, and background experiences (Valenzuela, 1999).

All of these varied experiences (as well as my own play background and experiences) influence my thinking and theorizing about play, and affect my *in situ* research choices, and my close examination of children's play in this study.

Researcher Role

My work as a teaching assistant over several semesters in the undergraduate play class also influenced my desire to seek a balance between a hands-off approach and a scaffolding one as I planned for my role as a researcher in the classroom. While sitting beside children, I worked to allow children opportunity to explore and try things out on their own, without undue or unsolicited adult input so that I could learn more about their interests, goals, and exploratory actions. Even so, I planned to provide scaffolding for children who might be interested in exploring more, but got stuck and seemed unable to figure out a move on their own. During the iPad interaction with Sam (explained in Chapter One), I found myself quickly and briefly pointing out key actions when he indicated confusion (e.g., how to find the eraser when he asked how to remove markings, or how to switch between drawing tools), and he easily and quickly adjusted his actions to incorporate the new knowledge and use it productively. Perhaps this enabled Sam to stay engaged with his exploration and experimentation for a longer period of time, but it did not offer me opportunity to see what he would have done if I hadn't stepped in so quickly. Throughout the study, I documented my struggle with the proper balance between stepping in and giving space.

I drew from several researcher models as I planned my role in the classroom. From several specific researchers (Dyson, 2003; Genishi & Strand, 1990; Wohlwend, 2009a), I learned that while sitting beside children for systematic observations of their exploration and play, I would assume multiple roles: teacher, patient watcher, listener, and restrained guide. In Genishi and Strand's (1990) ten-week Logo programming training study, the researchers allowed preschoolers a "'discovery approach' to instruction" through which they could "experiment in open-ended ways" (p. 266). The researchers prompted exploration of the technology and programming by asking questions such as: "Do you remember how to….?" and "What did you want to happen?" (p. 266). In Wohlwend's (2009a) study of writing and play interactions with children incorporating princess dolls into stories, she indicated her role as participant-observer who "videotaped, took field notes, and worked at tables with the children, participating in projects as necessary in a classroom where children expect adults to be helpful" (p. 63). Researching children's language and literacy development via multiple cultural and literacy resources, Dyson (2003) sat at the table with children as they learned to write and also followed them onto the playground for recess. Although initially a quiet observer, she eventually asked questions, while trying not to interrupt talk between children, and children eventually approached her, asking to be recorded. In each of these three studies, the researchers allowed children to explore, talk, draw, write, and create without too much (or too little) overt adult direction. At the same time, the researchers stayed close by and offered guidance, help, and support as needed, and asked questions for clarification of student intent. This participant-observer "positioning" within the classroom center as "approachable adult" was the role I tried to enact. I assisted as needed to help solve problems and/or ask questions of the students, and documented this process in my field notes. My role as researcher was interchangeable with my roles as co-learner, teacher, scaffolder, and curious observer. While balancing all these roles, I also worked to be respectful of children's feelings, perspectives, and comfort levels. I kept track of my choices and discoveries about maintaining balance of roles in my dissertation journal.

PROCEDURES

In this section I explain how I gained site access, detail the classroom plan, and include a table of the data collection timeline for each week of the 10-week study.

Site Access

Following research permission procedures for the university and school district, I contacted one approved site's principal and explained via email the key points of the proposed study. I asked if she thought the study would be a good fit for the school, and whether any of the pre-kindergarten teachers might be interested. To further explain my project to the principal, I made a short video of the research goals and activities and included a link in the email. The principal expressed interest, and after conferring with both teachers, she indicated that one teacher immediately agreed to participate in the study and the other said she would participate if needed. The interested teacher replied to my email invitation and we met at the school to talk over features of the study (key goals, timeline, participant responsibilities, and ways to end involvement if she or any child so chose). With the university's institutional review board (IRB) approval of the study, I delivered and collected the teacher-consent form. She then sent home student/parent consent forms to secure permission to study iPad explorations as a part of "center" activities in the classroom. Parents returned the forms and of the eighteen students in the class, fourteen parents agreed that their children could participate. The four non-consenting participants elected not to participate for a variety of reasons, including personal preference, health-related issues, and delayed school entry. The non-consenting students included three European American females and one Latino male. No consenting participants withdrew from the study. The teacher and I then arranged the dates and times for me to come to the classroom (Tuesdays, Wednesdays, and Thursdays from 8:00am to 10:30am) for ten weeks. Copies of all consent forms in English and Spanish can be found in Appendix A.

Materials

To learn more about children's exploration and play while using a technology-based tool, I selected a touch-screen tablet device as the tool for supporting children's digital play. Although many tablet versions are manufactured and sold around the world (see Table 1), as of April of 2012, the Apple iPad still accounted for the majority of tablet sales (Gartner, 2012). At the time of this study's design, the Apple iPad was the current leader in tablet sales, as well as a device being purchased by many schools throughout the country (for a few examples see: Chung, 2012; Hawes, 2012; Hu, 2011; Magen, 2012; Tayborn, 2011). Because of likelihood of access and the variety of available apps, I selected the Apple iPad2 as the touch-screen tablet device to be used by the children.

Table 1

Tablet Products Around the World

Country	**Manufacturer / Tablet**	**Described In**
India	Go-Tech *ATab*	Birch (2012) Remmawi & Sinha (2012)
India	DataWind *Aakash* (also called *Ubislate* in some markets)	Vaidyanathan (2012)
Thailand	Shenzhen Scope *Scopad SP0712*	Garun (2012)
United States	Fuhu *Navi*, Kurma *PlayBase Plus* Rulingnet *VinciTab* Archos *Child Pad* Isabella Products *Fable* Kidz Delight *Kurio* Oregon Scientific *Meep* Leapfrog *LeapPad* Vtech *InnoTab* Amazon *Kindle* Barnes and Noble *Nook Touch* Amazon *Kindle Fire* Microsoft *Surface* Samsung *Galaxy*	Buckleitner (2012) comScore, 2012 Consumer Reports (2012) Istook (2012)

The Apple iPad2 tablet allowed for software download of a variety of apps via an online store, and the number of available applications has steadily increased over the 2012-2013 study time frame. In addition, the iPad has very few buttons, is small and light, and young children seem to quickly learn how to navigate and use them. Lynch and Redpath (2012) explain, "The observational and interview data suggest that these young [kindergarten] students very quickly developed competence in the use of the iPad and iPod Touch devices, that they demonstrate a high level of motivation toward using these devices, and that, unlike with other forms of digital technology available in the classroom (e.g. desktop and laptop computers), these devices pose very few (if any) technical issues for this young age group" (p. 10).

Initially, I selected ten applications (see Table 2) for inclusion on the single Apple iPad2 to be placed in the classroom. I chose the applications by considering their opportunities for construction and dramatic play, and their allowances for students to have some level of control over creating narratives or images via various types of program templates or student-drawn/built images and characters. The application selection was a multi-staged process. At the outset, I began sorting through the large number of education-related iPad applications by first narrowing to applications that offered opportunities for some form of construction or dramatic play, and allowed for some user-generated content. As I began my search, I used online lists, reviews, and recommendations by teachers (e.g., Addis, 2012; Andrews, 2012; Gomez, 2012), parents (e.g. Taylor, 2012), organizations (Texas Computer Educators Association, 2012), and instructional technology specialists (e.g. Barker, 2012; Christo, 2012; Johnson, 2012a; Johnson, 2012b, Swanson, 2011).

Table 2

iPad Applications Used in the Study

	Sock Puppets (2012)	**Toon-tastic (2012)**	**Draw &Tell HD (2012)**	**Doodle-Cast (2012)**	**Scribble Press (2012)**	**Doodle Buddy (2011)**	**ABC Magnetic Board(2012)**	**Pocket Pond (2012)**	**Fluidity (2011)**	**Pattern Blocks (2012)**
	Smith Micro Software:	Launchpad Toys	Duck Duck Moose	Sago Sago	Scribble Press	Pinger	Tatiana Churanova	Trigger-Wave LLC	Nebulus Design	Braining-camp, LLC
Key Functions	Lip-sync and record video Conversation between puppets	Draw, animate, narrate, record own cartoons	Draw, color, add/ move stickers, and record talk about drawing	Draw and record voice using image starters or blank page	Draw, write, add stickers, photos & use book layout tool to create and share books	Draw, color, add/ move stickers & back-grounds	Create pictures using letters, numbers, shapes, &/or other objects	Agitate the water and watch fish respond. Add objects to pond.	Agitate the "liquid" and watch the colors, liquid, and bubbles respond. Alter speed and viscocity.	Compose designs geome-tric blocks and 4 colors of "pens". Alter back-grounds and block colors.
Template characters	√	√	√					√		
Template Background	√	√	√	√		√				√

Table 2 (Continued)

Template Props	√	√	√				√	√		√
Template stencils			√			√				
Stickers			√			√	√			
Drawing Tools		√	√	√	√	√				√
Draw characters		√	√	√	√	√				
Draw Backdrops		√	√	√	√	√				
Draw props		√	√	√	√	√				
Draw Text		√	√	√	√	√				
Sticker Text			√			√	√			
Type Text					√	√				

After producing an initial list, I visited developer websites and read reviews to learn more about the various applications to cull the list to include only those apps that seemed to offer opportunities for open-ended dramatic and/or construction play.

When examining apps I looked for the following features: design creation apps (e.g., picture composition, block building, book-making, story-creation, animation creation, voice recording); apps with differing available tools (e.g., paint, chalk, glitter, stamps, blocks, stickers); inclusion of some pre-programmed objects (e.g., backgrounds, shapes, letters); apps with differing foci (composing, recording, or simple movement-related apps); and apps with minimal inclusion of traditional text. I downloaded selected apps to my own personal iPad, and tested each for ease of use, minimal dependence on text, and the provision of tools for composing (via drawing, writing, animating, voicing, building), and recording. I wanted to include programs with lesser and greater amounts of freedom for student creativity (e.g., templates versus self-drawn characters, backgrounds, etc.), so as to provide both freedom for 'experts' and scaffolds for novices who might need more structured choices during their initial experiences. I chose programs that allowed different types of communication possibilities [recording voice, drawing or printing text, drawing or stenciling images, adding pre-made images ("stickers" or shapes), and/or recording animation]. After testing a range of programs, I decided on ten that I would include for student exploration and creation in this study. Table 2 lists and briefly explains the ten applications included in the study, and includes information on the tools within each app for drawing, image production, and text-creation possibilities. Each selected program allowed for varying degrees of creative freedom for the child user.

Classroom Plan

The data collection occurred over 10 weeks. These 10 weeks included three weeks of site-entry, participant recruitment, and classroom observation, five weeks of implementation of the tablet center and observations, and two weeks of follow-up and exit procedures. In the following paragraphs, I explain the protocol for the ten-week classroom procedures—my actions and the data collected (my reasons and plans for each type of data collection are explained in the Data Sources section below). At the conclusion of this section, I include a timeline of the classroom plan and data collection.

During the first three weeks of the study I met with the teacher and worked with her to disseminate and collect consent forms from interested families. During this time, I assisted the teacher as needed so as to build rapport, and to become acquainted with the students, the classroom routines (including the operation of centers), and the teacher's expectations. Each day I took descriptive field notes, focusing on the classroom context, as well as students' activities in play and literacy centers, including any interactions with technology devices, including classroom computers and a single classroom iPad. I also took photos of the classroom arrangement and of some examples of consenting students' non-digital writing, drawing, or other constructed creations. At the conclusion of each day's visit, I uploaded all fieldnotes and photographs to a Classroom Fieldnotes Log. In addition, I sent home a parent survey to gather information on the children's interests and experiences with technology, play, and literacy at home (see Appendix C for Parent Survey). I conducted two informal interviews (once at the beginning and once at the end of the study) of the teacher's technology use in the classroom, her initial assessments of students' play preferences, as well as children's technology, play, and literacy interests and skills (see Appendix B for Teacher Interview Questionnaire). Throughout the study, I also periodically queried the teacher informally about her classroom expectations and practices, and kept detailed notes of the results.

During weeks four through eight of classroom observations, I visited the classroom three days per week during morning routine and free-choice centers (8:00 am—10:30 am). During week four, after conferring with the teacher on the location and arrangement of an additional activity area, I introduced an iPad station as an additional choice (adding to the teacher's existing center choices and teacher-led activities). During week four, the station initially consisted of a single iPad at a little table with two student chairs, one researcher chair, one camera on a tripod, one researcher computer. In the beginning I had only one iPad for the students to share—matching the teacher's expectation of children working together on one device. However, during the second week of the iPad station implementation, I chose to include a second iPad—a decision that occurred through the emergent analysis of the data, which I will discuss at the end of this chapter.

Pairs of children were allowed to visit the center and choose to explore the 10 pre-selected construction play and sociodramatic play-related iPad applications, and I video-recorded, screen-captured, and wrote fieldnotes of their interactions. As per their typical class routine, during free choice centers the children had a variety of areas around the room in which they could choose to explore. The iPad station was one of many choices. The teacher reminded the children of the daily center options, and noted that an iPad station was an additional option. The children then went to centers using their normal classroom procedures by initially selecting a center to visit, and then staying or leaving at will. A student could come to the iPad station and then ask another student to join him or her. During the first week, as each pair sat at the table, I reminded them what the center was about (e.g., "At this center you can play some apps on the iPad. I'm here to help if you need it, and to learn how you use the iPad and these applications"). With the first couple student-pairs, I gave a brief verbal explanation of the applications and what children could do with them (e.g., "This is *Draw & Tell, HD*. You can use it to make drawings and record your voice"; and "This is *Sock Puppets*. You can use it to make puppet shows," etc). Children could then explore at will. After the first couple pairs of students, I decided to stop the brief explanations so as to allow children to explore independently. I tried to offer suggestions, guiding questions (e.g., "Are you looking for the eraser?"), or assistance only when requested (or when their faces and/or body language seemed to suggest frustration) to continue their exploration/play. I sometimes stepped in to answer questions when social assistance seemed useful to work through any arguments or confusion. As the children made choices, I observed (recording their gestures, talk, and program responses), answered questions, and supported the students' interaction with the applications as needed. Students had time (approximately 10 – 20 minutes) at the center to explore, experiment, and create with the selected application. Throughout the study, I tried to answer questions, assist in problem solving, inquire about their creations (e.g., "Tell me about your puppet show/drawing/design"), and ask for feedback (e.g., "What do you like about this app? What do you not like?").

Throughout the five weeks of the iPad station, each student was allowed a chance to come to the iPad center at least one time per week. We agreed that all interested students would have opportunity to get a single turn before allowed to engage a second time during a week. I used a timer, which would sound after 20 minutes (if students were still at the iPad station). The timer alarm alerted players that it was someone else's turn, and I reminded students they could return to play another day after other interested children had turns. I kept notes of who had turns each day, and the students suggested a 'sign-up sheet'—similar to ones occasionally used by the teacher for other popular centers—whereby students could write their names as a signal that they wanted a turn. During their times at the iPad station, they could choose any app on the main screen (which included icons for the 10 study apps and the Photos icon). Throughout these interactions I used a variety of data-recoding measures (video tape, screen-capture, and field notes).

During week nine of the in-class engagement, I began my exit strategy with students, winding down my personal engagement with the iPad station and planning with the teacher some transitional procedures for the center. During this time I asked students about their reflections on the applications, their creations, and the iPad station in general—but I tried not to intrude on their engagement too much. At the end of the study, I asked them to share which applications they liked most, which they liked least, whether they had used iPads at home, and what advice they might have for other kids their age or teachers who wanted to use these applications. I also conducted a final interview with the teacher (See Appendix B). Furthermore, I asked the teacher about information s/he desired to know more about including any other technology interests, application training, student responses, and insights gained from my observations.

During week ten, I shared project information with the teacher and assisted in the classroom centers as she indicated would be helpful. The teacher asked or a list of the apps I used in the study so as to add some apps to her own classroom iPad. Upon the conclusion of the study, the research iPad station was removed (as the research iPads were personal property of the researcher). For a summary of the classroom activities conducted by week, see Table 3.

Table 3

Study Timeline

	Investigator Research Activities in Classroom(s)	**Teacher-Focused Activities &** ***types of data collected***	**Student-Focused Activities &** ***types of data collected***	**Parent-Focused Activities &** ***types of data collected***
Week 1	Observe & assist in classroom to learn classroom procedures; answer teacher and parent questions	Meet & schedule study recruitment letter/consent; schedule acceptable researcher observation times	Take home recruitment letter and consent forms *Classroom fieldnotes*	Contact researcher for questions; sign/return consent
Week 2	"	*Informal Interview*	Return consent forms	
Week 3	"		*Photos of student drawings and writing*	*Parent survey*
Week 4	iPad Station and filming		*Up to 20 minutes total of interaction with pre-selected iPad apps (screen/audio captured for all, and video recording optional)*	
Week 5	"		*Same as above (video & screencapture with audio)*	
Week 6	"		*Same as above (video & screencapture w/ audio)*	
Week 7	"		*Same as above (video & screencapture w/ audio)*	
Week 8	"		*Same as above (video & screencapture w/ audio)*	
Week 9	iPad Station completion & turn over to teacher	*Informal Interview* & future strategy for iPad station	*Informal Interview*	
Week 10	Share findings with teacher	Exit	Exit	Exit

DATA SOURCES

In this section I explain the data sources I collected in order to seek answers that address my research questions:

1. In what ways do preschool children interact and engage with open-ended, symbolic-play related applications as indicated through their talk, actions, and interactions?

2. How does the classroom context seem related to the children's decisions, actions, and engagement with open-ended apps?

To address these questions, I collected two main sources of data (a) *observations* (videos of students' verbal/nonverbal interactions while at the iPad station, and screen-captures of application interactions), (b) student-produced *artifacts* (products created by the students via the applications). Additional data sources for contextualizing student behavior at the iPad station included *photographs* of the classroom and of students' non-digital drawings/writing; *field notes* of students' interactions at the iPad station and in the classroom; *informal interviews* of the teacher about children's school play, exploration, and technology experiences; and *parent surveys* of children's home play, exploration, and technology experiences. I also took notes of daily iPad station work, including the date, time, student pairs, applications chosen, questions/answers discussed with students, and interpretive notes. In addition, I took notes of the centers children visited when not engaged at the iPad station. In the following sections I explain my rationale and procedures for collecting each type of data.

Data Source 1: Observations ~ Videos and Screen Recordings

To understand better how young children approach, explore, experiment with, and create using open-ended, symbolic-play-related applications, I collected two types of observational data: videos of students' verbal/non-verbal interactions while engaging with construction and dramatic play iPad apps, and screen-recordings of their program responses. Below, I explain each type of data, as well as my initial expectations for the information possibly provided by each data source.

Videos of Student Verbal/Non-Verbal Interactions

The video camera at the iPad station was aimed toward the students' hands and torsos and the propped iPads in order to best see students' gestures toward the tablets. I purchased iPad stands that propped the iPad screens in a similar position to that of the teacher's existing classroom iPad in the computer area (which was on the opposite side of the room from the iPad station). My plan for the video camera was to capture students' words, gestures, and movements as they interacted with each other and the applications. This plan allowed for collection of information on their choices, talk, actions, and creations as they played with iPad apps. It also allowed me to examine the sequences of their choices with each app. In order to generate theory about children's processes of play, and their interests and experiences in this digital space, I felt it important to consider multiple factors that could give clues to how they explored and used the programs, i.e., the clues of gestures, vocalizations, actions, and social interactions. These data, then, informed my inquiry of how children interact, engage, and communicate in, around, and with these applications. Further, the videos allowed for my multimodal analysis of their multimodal explorations (see Flewitt, 2006).

Screen Recordings of Program Responses

A second important form of observational data was the screen-recording of the program responses to children's actions. While the video camera was aimed to capture children's gestures, talk, and movements, it was difficult simultaneously to capture clearly the program responses to student actions. I devised a method to record program responses by using screen-capture recording software (Camtasia, 2006) and wireless device communication software (AirServer, 2012). These two software programs allowed me to send a live, streaming image of all iPad actions to my laptop computer, and then record the images and audio of each program response to the children's actions.

This allowed me later to play back the moving images and audio alongside the video I had recorded for the purposes of examining the interplay between children's choices, actions, and program responses. I planned for these juxtaposed data (video and screen capture) to be used to extend my understanding of children's choices and actions as they interacted with the programs. The screen-capture images/transcripts were later paired with the video-recording images/transcripts in Transana (Woods & Fassnacht, 2012) to help me determine the processes children go through as they explore and create products.

Data Source 2: Artifacts ~ Products Created by Students

In addition to the video recordings and screen-captures of children's interactions, I also collected student-created products from the various applications. Each application has its own product possibility. Depending on the app, the product might be a finished drawing/painting/shape design, a drawing with recorded animation and voiceover, a multi-scene animation, an e-book, or an animated puppet show. The products created by the students enabled me to examine more closely the symbolic representation children used in this digital play space. I hoped these data might inform the research question related to children's approaches, and possibly give insight into their interests and goals. Because each program stores the product within the application itself, I could examine and transcribe information from these products directly from within the iPad applications.

Data Source 3: Informal Conversations with Children

The informal conversations with children occurred spontaneously throughout the iPad station work. I planned for informal conversations to help me clarify children's choices, interests, preferences, curiosities, and stances as they interacted with the iPad apps. While students were at the iPad centers, I periodically asked unstructured, open-ended questions to clarify/understand what they were doing/making. I worked to ensure that questioning of the children was situated in the context of their play with the applications, and did not distract them from their experiences. The purpose of the questions was to elicit verbalizations of what they were doing and thinking during their engagement with the apps. I hoped this might help me better understand their intents and purposes as they made choices (as well as help me better understand their perspectives rather than forcing my own) (Glaser, 1992). Some sample conversation openers included, "Tell me about what you are doing?" or "What are you noticing?" or "What do you think about that?" Toward the last weeks of the study, I also asked questions such as: "What are your favorite applications?" "What do you like most about this?" "What advice would you give to other kids who want to use this application?" I used the camera to record these questions and answers, because stopping to write down information took too much time and could have distracted young children from what they were doing. My intent was to draw minimal attention to myself/my work, in order to understand better the students' interactions. As completely as possible, I jotted down any notes of points I wanted to remember as I observed student pairs, and added to these notes when I returned home. Upon returning home from each day's data collection, I reviewed the tapes, updated my notes, uploaded video-recordings to my computer, paired them with the screen-casts using Transana (Woods & Fassnacht, 2012), began open-coding and memoing to note key issues (in my "reflections on fieldnotes" journal—my developing codebook), and jotted down any issues and/or speculative thoughts in my "Reflections on My Actions" journal.

Additional Data Sources

I collected several forms of data toward contextualizing children's iPad play choices and actions. I planned for these data to inform the second research question, which asks how the classroom context might be related to children's choices, actions, and interactions. Additional data sources included observation notes about the classroom (general classroom arrangement, play opportunities, technology-related activities), photographs of the classroom and of student drawing/writing (non-digital), a home survey of parents (asking about students' home experiences with play, literacy, and technology), and two audio recorded informal interviews with the teacher (on the classroom goals and affordances for play, observations and perceptions of students' creations, and noticings about students' iPad experiences and creations). I hoped these additional data sources might help contextualize children's choices while at the iPad station, giving additional data points for grounding theory. Most of these data sources were collected throughout the ten-week study, while the parent survey occurred once at the beginning, and the teacher interviews occurred at the beginning and end of the study. (For parent survey and teacher interview questions, see Appendices B and C.)

Issues of Privacy/Confidentiality

The teacher's privacy was protected by allowing her control over how much she wished to share in the interviews; she could skip any questions she felt uncomfortable answering, though she did not indicate unwillingness to answer any of the interview questions. Parents' privacy was protected by allowing them control over whether and how much to share in the survey. Children's privacy was protected by allowing them choices about whether to come to the iPad station, and, once there, to choose from among a variety of apps for exploration. I worked to avoid pressuring children to continue interaction with a given application if the child seemed uncomfortable or unengaged. I also allowed children the freedom to answer or not answer any questions about their experiences, thoughts, and creations. Furthermore, while video data were very important for this study, I gave parents a choice about video-recording. For those who did not wish to take part in the study (parents of four students), I did not collect data on their choices and actions. For those who did participate, all work was screen-captured (described in the next section), but parents could choose for their children not to be video-recorded if they so wished. Of the fourteen participants, one parent requested that her child's face not be shown in public data presentations, and that request has been honored.

I protected confidentiality of all participants by adhering to the institutional guidelines of all research involving human subjects. At the outset of the study, I created pseudonyms for each participant, linked to real names in a master key file. I positioned the camera to mainly capture students' torsos and hands, and turned the camera away or off of non-participating students.

Trustworthiness

Internal/external validity, reliability, objectivity, credibility, transferability, dependability, and confirmability are all terms that have been used when trying to define the elements and practices key to ensuring rigor and trustworthiness in a study (Merriam, 2009). In classic grounded theory, the point is not verification or full conceptual description, but rather the development of substantive theory around a core category, which emerges from the data (Glaser, 1978, 1992, 1998). For building grounded theory, the terms Glaser (1992) used to explain credibility and trustworthiness of judgment are: fit, work, relevance, and modifiability. The researcher must continuously examine whether the concepts, categories, and properties of categories fit the data, are relevant to the participants, and whether the emergent core category fits the participants' main concern. S/he must question how well the theory "account[s] for the variation in the dependent variable" (1992, p. 92). Furthermore, the theory should be modifiable so that it can continue its fit and work and relevance. Concerning generalizability, Glaser (1992) notes, "What applies to grounded theory is its generalizability from a substantive theory of limited scope to a process of larger scope with parsimony, based on its ability to fit, work, and be relevant" (p. 117). I have worked to maintain "fit, work, and relevance" through the extensive use across multiple data sources of constant comparative analysis, and I have kept track of the steps taken throughout the process.

In keeping with the grounded theory package (Glaser 1978, 1998) I have followed and kept track of the procedures for collecting and analyzing data in several ways. I have used data analysis strategies that include engaging constant comparative analysis, writing multiple lists of codes/themes/categories, and memoing (Glaser, 1978, 1992, 1998). Memoing in my "reflections on fieldnotes" journal helped me keep track of my "theorizing write-ups of ideas as they emerge, while coding for categories, their properties, and their theoretical codes" (Glaser, 1992, p. 108). I also kept track of my responses to data analysis by maintaining a chronological "reflections on my actions" journal. Once the initial theory began to emerge, I used theoretical sampling to examine the properties of each category for confirmation or contradictions. I combined information from multiple sources (video data of student actions and tablet responses, classroom observations, teacher interviews, and student interviews) to triangulate the data and clarify interpretations (see data analysis in the following section). In addition, I periodically engaged in peer debriefing with knowledgeable faculty and colleagues about my work and progress in order to gain feedback and continue examining my thinking about possible assumptions and biases. After drafting my theory, I revisited the literature and looked for examples of earlier findings that were consistent or contradictory with the findings of the current study. I then compared my findings with the literature and included citations throughout my results chapter. Through this method, I was able to develop theory that emerged from the data rather than using the data to confirm existing theory. Because the concepts that emerged are explained not with definitions but with *properties* of each developed category, the theory is open to modification by future researchers with additional properties that might arise in other settings.

DATA ANALYSIS

Multiple data points (e.g., observations, interviews, surveys, additional data sources) in various forms (e.g., field notes, video-recordings, screen-capture recordings, photographs, application products, survey answers, notes) amounted to a plethora of information for analysis. As suggested by Creswell, (1998), for each set of data, I took actions to "read through the text, make margin notes, form initial codes" (p. 148). Across the sources, I used a range of coding procedures associated with grounded theory: open coding (looking for categories, properties, and dimensions), theoretical coding (looking for how categories might interconnect), and developing theory (making theoretical propositions and hypotheses) (Glaser, 1978, 1992, 1998). The types of analysis and coding used depended on the type of data, my associated analysis goals, and the reflexive nature of the coding, emergent findings, and slight alterations of procedures to fit the needs and interests of the students. In the following sections I explain the various data points and my associated goals and analysis strategies. After explaining my initial plan for each type of data, I explain how on-going analysis during simultaneous data collection shaped and guided the procedures. I demonstrate the evolution of the study and prepare for the findings to be shared in Chapter Four. A summary of the initial plan for data sources and the related data analyses strategies are presented in Table 4.

Table 4

Initial Data Collection & Analysis Strategies Summary

Data Source	**Time-frame**	**Description**	**Initial Data Analysis Strategies**
Field Observations and notes	Weeks 1-3	Note children's non-digital exploration, play, creation activities & interests, and their other tech experiences	Coding for classroom context, individual interests in other play areas, and individual interests at iPad
Teacher Interview	Weeks 2-3	Informal interview of teacher on students' school play and technology preferences and experiences	Coding for contextualization of student experiences, beliefs about play, teaching, classroom arrangement
Parent Survey	Weeks 2-3	Written survey for parents of children's home play, and tech access and experience	Describing background info on individual students' play and tech experiences
Videos	Weeks 4-8	Student-pair work with applications at iPad Stations; informal interviews	Coding for student actions, gestures, expressions, language, patterns of play
Screen-cast recordings	Weeks 4-8	Student-pairs work with applications at iPad Stations;	Coding for program responses to connect with video data of child actions
Application Products	Weeks 4 -8	Products created by students	Coding for student actions, content, type of design
Teacher Interview	Week 9	Informal interview of teacher on students' iPad work	Describing contextualization of student experiences

Analyzing Observations: Classroom Fieldnotes

Throughout the study, I took fieldnotes relative to whole-group activities and student choices during center time. During the first three weeks, these notes included more detail about student choices during center time, but even during the iPad station implementation, I jotted down as much as possible about the centers children chose to visit, as well as notes on students' choices at the iPad station. Upon returning home each day I scanned my hand-written notes and uploaded them along with any photos to a "Classroom Fieldnotes" document, adding additional details while events were fresh in my memory. I also began a document I entitled, "Reflections on Fieldnotes" wherein I jotted down my thoughts and questions around initial coding. In this log I began my first pass at categories of student actions, including category headings and specific student examples with the associated date for each example (see Figure 1 for a small sample). The codes included three areas of focus: codes of teacher actions, codes of student actions away from the iPad, and codes of student actions at the iPad (see Figure 1 for a sample of codes in the students-at-iPads focus area). This first code-log ran from weeks one through five of the study.

HOW DO THESE GADGETS WORK – this might also be a form of 'trying it out' but on a larger level, such as how the various tech items (computer, speaker, ipad, button, stylus) work

- a talking into speaker "hello, hello... " and Wayne too (dec 3)
- Cherry noticing the computer and ipad are the same (dec 3)
- how to hold the speaker (to your ear...Wayne) (dec 3)
- Cherry curious about how the computer mirrors the ipad (dec 3)
- Cherry curious about how the screen got bigger – I show her double tap (dec 3)
- Cherry trying to play fluidity on computer screen, but it doesn't work so she tries the ipad (12/3)
- Maya trying to move the characters but toontastic is playing back, so she then tries to get her finger to follow (12/3)
- "what's this?....push something!" (Soph to Toph on 12/4)
- Soph checking out camera, twisting screen and looking at it (12/4)
- 'what is that for?" Simone about camera (12/4)
- Simone noticing that my computer was a mirror of her image, and trying stuff and then standing up to look over at my computer
- Marie wanting to check out camera...and saying, "I see you sar! Come see me!" (12/17)

MIMICKING/Matching FRIENDS – one person does something and then another friend does it too (this might be related in some way to trying it out, because sometimes one person tries something and the other person wants to get the same result so they try it too).

- Wayne mimicking Maya talking into the speaker (dec 3)
- "wait can I try?" Maya mimicking Wayne holding speaker to ear (dec 3)
- Wayne to Maya, "no, go like this" (tapping screen during fluidity) and ari mimics (dec 3)
- M: "HELLO" Maya: Hello in toontastic (12/3)
- Beth trying to draw a cat after simone drew a cat (12/5)
- Maya trying doodlebuddy after she saw vera doing it (12/11)

Figure 1. Screenshot sample of early coding from "Reflections on Fieldnotes" Journal

It was through the writing up and re-reading of these emerging findings about the children's difficulties in sharing and working together that I concluded I might need to add a second iPad. During the first week of the iPad station, I thought I might be able to resolve the difficulties by having students discuss their turn-taking plan before beginning. However, after four days of iPad station data collection (and repeated reading/writing about the fieldnotes and my responses), the data emerged that students' mains concern centered most often around "getting a turn." In order to learn more about children's interests when they were *not* worried about getting a turn, I made the decision to provide a second iPad, and included it during week two of the iPad station implementation.

In addition to guiding my study design at the beginning of the study, I also used the "Classroom Fieldnotes" data to triangulate my data when looking for possible patterns of individual student interests as well as classroom context that might be co-occurring with students' choices, actions, and play frames at the iPad station.

Analyzing Observations: Video-recordings Paired with Screen-casts

After each classroom visit, I paired video recordings of children's interactions at the iPad station with the screen-casts of their program responses. This allowed me to inspect for children's choices of activities, the range of talk, their movements and actions, as well as their in-process creations as they engaged with the existing iPad apps. It also allowed me to examine the sequences of their choices at the iPad station. I used Camtasia 2 (2006) software to sync these two types of video recordings, and then uploaded them to Transana (Woods & Fassnacht, 2012) for transcription and analysis as explained below.

After the first three week of video recordings, the school was closed for the winter break. During this time I transcribed the Week One videotape/screen-cast pairings of students, including their language, gestures, and choices. I used Transana (Woods &

Fassnacht, 2012) to create transcripts with time-codes linked to the synced student videos and screencast videos (see Figure 2).

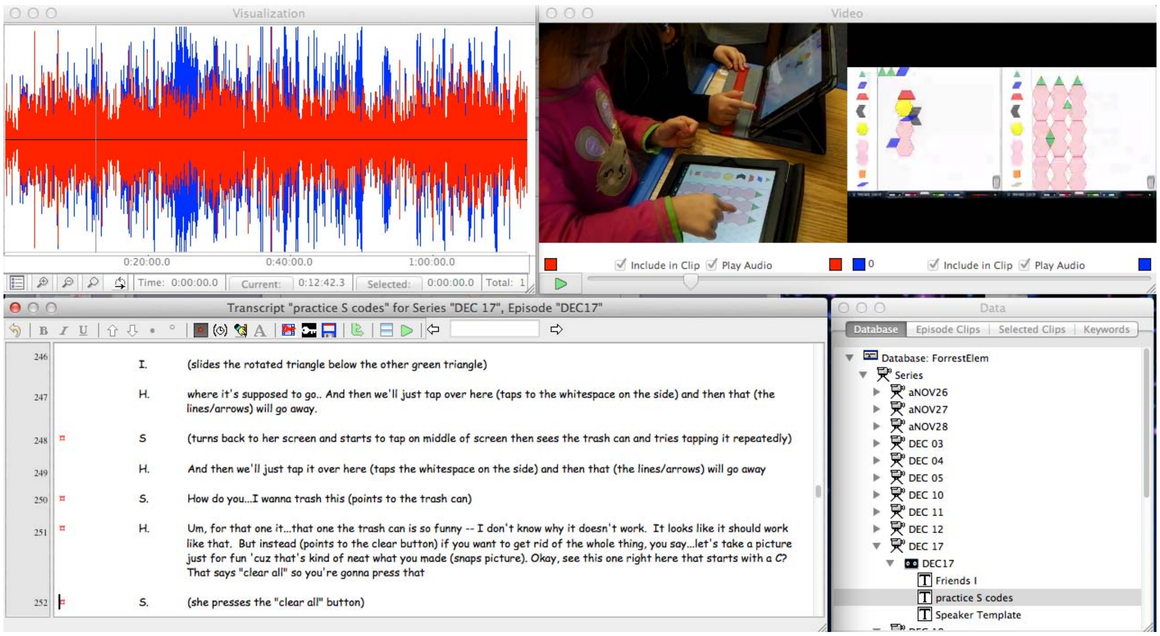

Figure 2. Screenshot sample of synced videos and transcripts in Transana

After transcribing this first week of data, on a separate word processing document entitled “Possible Codes,” I began open-coding (Glaser, 1978, 1992) by examining the data for patterns and possible code categories (see Figure 3).

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Below are codes I came up with for the first few pages of DEC17 transcripts...I also inserted them into the transcript itself (though I stopped before going all the way through because it still felt too descriptive and not yet conceptual enough).

> Situating new info: how does this fit with past experiences
>
> Navigating gadgets...help from teacher
>
> ------------
>
> Scanning choices – choosing from available options
>
> Scanning choices – choosing what friend chose
>
> ------------
>
> Unanticipated happening → a need to resolve problem
>
> Unsolicited help → from teacher (needed, not needed, taken, ignored)
>
> Unanticipated happening → unknown solution → quitting
>
> Unanticipated happening → unknown solution → trying solutions
>
> Unanticipated happening → unknown solution → soliciting help → from teacher
>
> Unanticipated happening → persistence in restarting
>
> Unanticipated happening → serendipitous oops
>
> Happening → unknown solution → soliciting help
>
> --------------
>
> Investigating: (how to manipulate program, how to modify medium)

Figure 3. Sample of early open-coding of student actions and responses at the iPad station

These codes were inserted directly into Week One transcripts for several student pairs. As I began looking at the Week One transcripts to name concepts on students' choices and actions, my first set of codes revealed over-lapping qualities, particularly around the categories of student actions, program responses, and social interactions (with peers and with me). This second set of codes (second to the code log for Week One—Week Five noted above) included examples of children's information seeking behaviors (e.g., scanning, soliciting help), exploratory actions (e.g., investigating, experimenting, discovering), deliberate creation actions (e.g., creating), and social interactions (e.g., making connections, assisting, requesting, demonstrating). However, I wondered about how beginning actions/interactions during Week One might be different from more experienced actions/interactions, and so I then transcribed in full detail the Week Three iPad station interactions in order to compare children's initial actions with more experienced ones. As I began open-coding the Week Three transcripts, I looked for patterns of children's actions in apps using constant comparative analysis. Glaser (1992) explains:

> Two analytic procedures are basic to constant comparative method of coding. The first pertains to the making of constant comparisons of incident to incident, and then when concepts emerge, incident to concept, which is how properties of categories are generated. The second is asking the neutral, coding question referred to above: what category or property of a category does this incident indicate? These two procedures, when used carefully without preconception, yield the initial categories and properties in open coding. . . By breaking down and conceptualizing the data we do not mean taking apart a single observation, sentence, or paragraph, and giving each discrete incident, idea, or event a conceptual name, which indicates something that stands for or represents a phenomenon. . . .We do mean comparing incident to incident and/or to concepts as the analyst goes through his data. We look for patterns so that a pattern of many similar incidents can be given a conceptual name as a category, and dissimilar incidents can be given a name as a property of a category, and the compared incidents can be seen as interchangeable indices for the same concept. And when we get many interchangeable incidents we get saturation. (pp. 39-40; underlined text in the original)

In order to form a deeper analysis, I realized I needed to delineate what might constitute an "incident" for constant comparative analysis. I chose to define an "incident" in my data as the period a student spent in a given app—from the time they opened the app until the time they closed the app. Because my first pass through the data was to compare initial Week One incidents with later Week Three experiences, I decided to count and time every student's incidents for every iPad visit during Weeks One through Three. I made a chart for each student, including his/her pseudonym, the apps, and the date/amount of time spent in each app. I also made charts of a) how many times each child engaged with each app, b) who they partnered with each week, and c) the play path of apps chosen by partners during each sitting (i.e., the order of who opened/engaged each app across the entire visit). In addition to the charts, I also wrote short paragraphs on children's partners across different days and wrote a few reflective notes about the kinds of choices students made when with differing partners. After completing the final two weeks of iPad station data collection, I completed the charts with the additional data information, resulting in 14 individualized student charts, with a combined total of 374 separate timed incidents.

Through the process of creating the individualized charts, partner charts, and play-path charts, I noticed two recurrent trends: 1) at times, students switched programs in rapid bursts, and at other times engaged with a single app for a longer period of time; and 2) leading/following behaviors were common between student tablemates, particularly in app choice. I decided to investigate the possible differences between the short app visits and the longer app visits, as well as the possible social interactions that seemed to be linked to the children's iPad station play.

After I collected the final weeks of data and added the videos and transcripts into Transana (Woods & Fassnacht, 2012), I began making keyword clips in Transana—using my charts to guide my selection of the three students with the shortest amounts of time in apps, and then looking for those same students' longest times in apps. I then used the individual charts to find the three students with the longest periods of times spent in any apps, and also coded for their shortest times spent in any apps. I made video clips of open-codes (e.g., program hopping, with codes including exploring, experimenting, and searching), and developed a set of codes for the behaviors indicated in each clip. I wrote up these initial findings of the varied aspects of what I labeled "program hopping" and "program landing" and shared them with other early childhood experts who asked probing questions that encouraged me to delve back into my data for another look not only at the amounts of time children spent in programs, and the types of actions they took inside each app, but also to consider how/whether their actions might be play or playful.

I then went back into my data and began making index cards of incidents for each participant, describing in narrative form what a child said and did from the opening to the closing of an app. For the total of 374 incidents (analytic units comprised of the total time a student spent engaging with a single app), I created index cards (one for each incident) and did open coding on 129 incidents to develop my initial substantive codes. Those 129 cards included all incidents of the students with the highest (Maya: 52/5) and lowest (Tony: 14/4) scores for the incidents to visits ratio (number of incidents divided by number of visits). That is, across all weeks, Maya engaged in 52 app incidents across five visits to the iPad center, while Tony engaged in 14 app incidents across four visits. The initial set of 129 cards also included incidents for the initial tablemates of Maya (Wayne: 41/6) and Tony (Glenn: 12/2) to see the interactions between the tablemates of these two students. I then collected incidents for Wayne and Glenn across the study as they engaged with subsequent tablemates—Juan (30/4), Sofia (28/6), and Will (11/3)—across the study. This allowed me to examine a range of student actions from those who made many different app choices across weekly visits (e.g., Maya, Juan), through to those who made fewer choices across fewer visits (e.g., Tony and Will). (See Table 5 in Section 4 for a complete listing of participants' frequency of visits, partners, and incidents.) With this initial set of 129 incidents, I coded each incident for emergent concepts (allowing for multiple codes for each incident). The codes included my interpretation of what the child seemed to be doing in his/her actions (e.g., trying another's strategy, inviting another to try one's own strategy, telling rules of a play frame, seeking something new, making creation, trying a tool, looking for something). For an image-example of these incident cards with codes, see Figure 4. It is important to note that the classic grounded theorist should try to remain open to theoretical codes. One can later take up a certain theoretical perspective, but only as it arises through the constant comparative analysis of the data. As noted by Breckenridge, Jones, Elliott and Nicol (2012), the concepts should present:

> …plausible hypotheses about participants' behaviour. The focus is not on producing and verifying facts, findings, or accurate results but in generating concepts that are variable and modifiable (Glaser, 2004). As such, it is acknowledged that concepts generated in classic grounded theory will indeed have different meanings to different people, but whatever the meaning, the concept will still exist. (n.p.)

Thus, as I examined incidents, I kept in mind that I was looking for naming concepts rather than simply describing each specific action (though indeed, the concepts were descriptive in nature). The initial open coding offered the opportunity to find several concepts in one incident. Noting multiple concepts and then comparing them allowed for examples of dissimilarity that helped properties of categories to emerge.

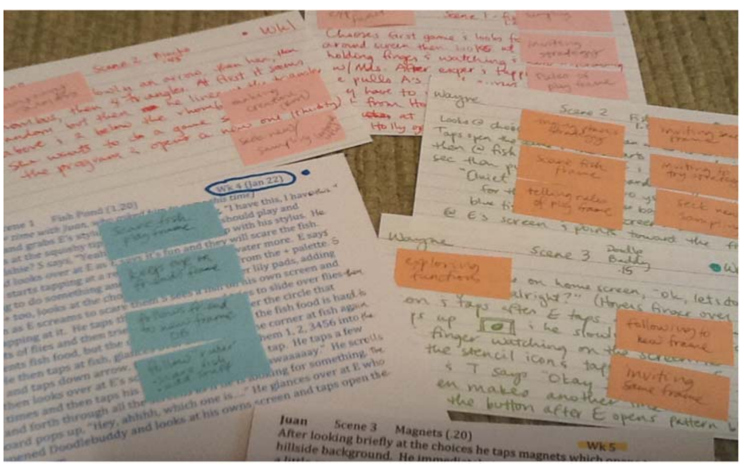


Figure 4. Sample incident cards with multiple codes

I next took this initial list of substantive codes and examined the incidents of remaining students, combining and collapsing concepts into categories. After I open-coded the first 129 incidents and began to identify categories and concepts, I reviewed the remaining video-linked transcripts in order to flesh out and deepen the concepts, categories, properties, and theoretical codes. My plan was to develop categories "first in terms of [their] properties and second in terms of [their] theoretically coded relationship[s] to the to the other categories and properties and primarily to the core category – to wit the basic social process involved" (Glaser, 1992, p. 46). I constantly referred to Glaser's (1978) theoretical coding categories to guide my work in this area (in this text he lists 18 coding families, but notes in his 1992 work that "Eighteen coding families is not the limit. Studying in them will spawn others" (p. 46). The coding families I drew from included the degree family (e.g., amount of time), the dimension family (e.g., aspects of experimenting), the type family (e.g., types of play, types of creations), and the interactive family (e.g., interaction of interests and persons).

In addition to coding, I also wrote analytic memos, and referring back to Glaser (1978, 1992, 1998). I used this process to help me, as much as possible, not to force the data into preconception (Glaser, 1992, 1998). Through these processes I was able to develop a rudimentary theory of children's social dual-tablet play with open-ended iPad apps, and will present the model and the explanation in the following chapter.

Analyzing Artifacts: Student Created Products

Each application has its own product possibility. Depending on the app, the product might be a finished drawing/painting/shape design, a drawing with recorded animation and voiceover, a multi-scene animation, an e-book, or an animated puppet show. I examined products for content, type of design, and evidence of students' stances as well as possible interests while creating the product (e.g., did they seem interested in creating a finished product, or seem more interested in the process of creating, and for whom/what purpose was their composition being created?). These data were coded using open and theoretical coding from product to product (e.g., patterning, representational image or scene), and also connected to the context in which they were created. Each product was viewed via the video and screen-capture data so that the products could be considered within their context of creation.

Analyzing Informal Questioning

To clarify children's choices, interests, preferences, curiosities, and stances as they interacted with the iPad apps, I occasionally asked unstructured, open-ended questions about what they were doing/making. Children's answers to these questions were captured by the video camera and audio on screen-recording, and were included in the video-recording transcripts and incident notes. At the end of the study, I also asked students to tell me about their favorite and least favorite apps played during the study, as well as any previous experiences they might have had with digital tools, and what advice they might have for others. I transcribed and added their responses to my tables document (tables of apps, partners, time-in-app, play paths) in order to allow for comparison between student responses, and to offer additional contextual information on the choices they made. I also used this information to examine whether their actual choices (the types of engagement and amount of time spent in an app) seemed to match their stated favorites/least favorites.

Analyzing Additional Data Sources: Interviews, Surveys, Field Notes, Photographs

While the main data sources for analysis were the videos of student work, paired with the screen captures of program actions, and the final created projects, I also created transcripts of teacher interviews, tallied results of parent surveys, and assembled/organized field notes and photographs of student work. These data helped me better understand the contexts surrounding children's exploration, play, and creation at the iPad station.

I reviewed these expanded field notes for contextual influences on children's play, literacy, and technology experiences, as well as how they might indicate students' interests. These notes included handwritten notes, drawings, and post-observation typed recollections of students' classroom play and interactions. I reviewed these notes during the constant comparative analysis of the transcripts and incident cards, and used them as triangulation data on the context surrounding the choices students made.

Although I photographed student creations in spaces outside of the iPad station (e.g., drawings, block constructions, journal entries), I rarely referred to these for confirmation of student interests during the constant-comparative analysis of video and screen-capture data, but hope to use them more in future research analysis. These data may be used in the future to better understand individual students' interests and main concerns, and could be used for comparison of digital versus non-digital creations.

Informal interviews of the teacher occurred at the beginning and end of the project (See Appendix B), and were audio-taped and transcribed. The transcripts of these interviews were reviewed for contextual classroom influences on children's choices and classroom culture/teacher expectations. They were referred to periodically as confirming or disconfirming evidence of the classroom context as the video and screen-capture data were closely examined.

Surveys of parents were sent home at the beginning of the study to collect information on parents' perception of their children's home play and technology experiences. The results were compiled and organized by student pseudonym and question content, and served as both a reference point when needed by the researcher to better understand a student's background technology experiences as well as their other play interests.

I used these analytical processes (transcript and incident analysis and coding, table creation and notation of choice patterns both individually and across pairs, reflection and inclusion of contextual data, analytic memoing, reflection journaling, discussions with committee members, continued reading of grounded theory writings (Glaser, 1978, 1992) and literature on exploratory play and social play) to address my research questions, and to guide my development of a hypothesis on the socially situated types of play engaged in by children in a particular classroom context. In classic grounded theory the researcher is *not* verifying existing theory, but developing data-grounded hypotheses about processes.

Chapter 4: *Findings*

The purpose of this study was to develop a greater understanding of children's exploration and play with open-ended, symbolic-play-related touch-screen tablet apps. This study was guided by two research questions:

1. In what ways do preschool children interact and engage with open-ended, symbolic-play related applications as indicated through their talk, actions, and interactions?

2. How does the classroom context seem related to the children's decisions, actions, and engagement with open-ended apps?

In order to answer these questions, the study was conducted in a classroom of 18 pre-kindergarten children (14 of whom were participants), with an additional classroom center designed by the researcher to gather data on children's approaches and play with pre-selected symbolic-play related iPad apps. The data collected included over 25 hours of video (12 hours of screen-capture data, and 13 hours of student-action data; difference between screen-capture and video data was due to screen capture malfunction with two apps) as well as 85 minutes of classroom video, 55 minutes of teacher interview audio, 50 minutes of student interview audio, daily fieldnotes, classroom photographs, and five completed parent surveys.

Review of these data revealed the complex combination of elements around children's approaches and play with open-ended iPad apps. There were patterns across students, and individual differences as well. Each student engaged his/her own stylistic approaches and personal preferences toward the research iPads/apps, and their choices were tracked across a period of five weeks that included repeated visits with different partners (See Table 5 for demographic information on each participant).

Table 5

Participant Demographics

Name & Week One Age (Months)	**Ethnicity**	**Visits**	**Partners**	**Incidents***
Sofia (54)	Latina	6	5	28
Maya (56)	Bi-racial	5	4	52
Beth (55)	European-American	7	7	40
Juan (57)	Latino	4	3	30
Marie (56)	Asian	4	5	27
Lela (58)	Asian	5	5	24
Tony (59)	Unknown	4	3	14
Simone (53)	European-American	5	4	38
Cherry (63)	Unknown	5	4	18
Glenn (55)	Asian	2	1	12
Vera (58)	Asian	4	3	23
Will (56)	Asian	3	2	11
Wayne (59)	Unknown	6	5	41
Topher (56)	European-American	5	5	30

* Several students shared an iPad during the first 4 days of the study and incidents were counted for each person, resulting in some doubled incident numbers.

Each of the 14 participants came to the iPad station an average of 5 times, staying for an average of 15 minutes during each visit. Due to student choice of partners, all students had different partners for most of their visits, but 13 of the 14 students visited with the same partner twice, and two students visited three times with the same partner. Furthermore, there were four occasions in which a player had two partners due to the early departure of one partner and the subsequent arrival of a second. Non-participants are not included in the participant list in Table 5, but are counted as partners when appropriate. Analytical units (herein termed, "incidents," as defined in Chapter 3) were derived by including all the actions and choices made by a student from the time s/he opened a single app to the time s/he closed it (by pressing the home button) in order to open another app. There were a total of 374 incidents (or separate experiences with apps) in the study. (Note that in Table 5, some incidents received double counts when two students sharing a single iPad engaged with the same app together.)

Constant comparative analysis of even a single child's experiences across the study revealed individualized stylistic patterns and preferences, as well as situational variables (e.g., past experience, program responses, partner/researcher/classmate influences) that may have impacted and shaped each session, which in turn influenced later sessions. However, because the current study focused on developing a grounded theory of children's play when using open-ended apps on a touch-screen tablet, I examined the data for possible repeated patterns throughout the incidents of children's interactions with this particular play material. The themes and categories shared are examples of repeated patterns grounded in the data as exemplified by participants in complexly stratified ways. This complexity was due to the dynamic relationships between the child, the tool, and the social setting connected with a child's play in a given moment.

As outlined in Chapter Three, I used the classic grounded theory process of substantive coding in order to find emergent concepts, and then organized those concepts into categories, properties, and theoretical codes. I used constant comparative analysis (Glaser, 1978, 1992, 1998) for the emergent concept development and concept integration. I used open-coding across incidents for each student in the study in order to generate emergent categories, then collapsed the initial open-codes into the substantive codes of three different types of play outcomes and one type of behavioral approach evidenced by children engaged with open-ended iPad apps. I then continued with selective coding to name the properties of three ways children engage with open-ended iPad apps, as well as a means by which they gather ideas for their choices. I also examined the social context of the classroom environment as arranged by the teacher, as well as the personal and social interests of the children in order to determine how children's choices and actions were related to each other and to the context. I then combined the substantive and theoretical coding into a model of pre-kindergartener's socially situated parallel tablet play with open-ended iPad apps.

Through this process I was able to develop a rudimentary theory of children's parallel tablet play with open-ended iPad apps, and I first present the findings via data-based examples. In Chapter 5, I present and explain the model I developed around these findings. In keeping with grounded theory (Glaser, 1978, 1992, 1998), the sharing of data is not to merely describe what happened: grounded theory is not a descriptive methodology in the ways that other qualitative methodologies (e.g. ethnography, case study) are "designed to provide an in-depth description of a specific program, practice, or setting" (Mertens, 1998, p. 159). Rather, the goal is to use the data as a basis for developing a theory. However, in order to elucidate the data-based concepts and theory, I include description of participant choices and actions as evidenced in the data. The organizational structure for the chapter is as follows: review of three student approaches toward open-ended apps (sampling, experimenting, and engaging in pretense), review of the social context surrounding students' choices (teacher beliefs and actions, classroom organization, students' personal and social interests, technical issues), review of the concept of reflexive tracking, and summarization of the study findings.

APPROACHING IPAD APPS THROUGH SAMPLING, EXPERIMENTING, AND ENGAGING IN PRETENSE

Across the wide spectrum of participants and their varied actions/interactions, three categories of student approaches emerged from constant comparison of student experiences with the ten apps in the 374 recorded incidents: *Sampling, Experimenting,* *and Engaging in Pretense*. Although earlier research has included similar categorizations (Couse & Chen, 2010; Escobedo, 1999; Labbo, 1996), these categorizations were not predetermined in the current study. Instead, each of these categories has emerged from constant comparative analysis of student actions while they were engaged with a given app. The properties of each type of approach will be explained in further detail in the next sections, accompanied by two illustrative examples from the data. Although I developed these categories via constant comparative analysis, the three types of approaches can be linked to play categories in the existing play literature, as will be alluded to in the following sections, and discussed further in Chapter 5.

It is important to note that the categories developed in the current study will not be finitely defined, because a major goal of grounded theory is to specify properties rather than definitions of concepts. As Glaser (1978) notes,

> Conceptual specification is the focus of grounded theory, not conceptual definition. This is because the operational meaning of the concept derives from the use of its earned distinctions in the theory. . . In this way the meaning of a concept can be modified or added to—as indicators change—thereby changing the applicable distinctions thus the concept's meaning. It is hard to keep changing a conceptual definition. In contrast, generation can easily keep changing distinctions for operational reasons as the theory emerges. (p. 64)

Finally, although the data in this study were necessarily linked to individual players, the purpose of analysis was not to categorize individual children, but rather to note types of actions that might be seen at different times and in different situations with many children. This search for patterns across the many incidents is made more complex by the socially situated nature of children's choices. Each choice an individual made cannot be removed from the social context in which it occurred. Therefore, in the examples shared for each of the three types of approaches, I worked to include the multiple and varied ways students engaged in these approaches and behaviors, along with the context surrounding student choices and actions. A more focused examination of the social influences will be examined in a separate section on the sociocultural context.

Sampling: Brief Manipulative Play For Discovering Possibilities

Sampling is an approach observed at least once by all 14 participants in the study, and it occurred more than once for many of the students. Over the total 374 incidents, sampling was evidenced in 32% (120 incidents) of the 374 total incidents. Children used sampling as a means of introduction to a particular app's affordances, or sometimes a brief return to a previously app experienced app. The introductory form was linked to students' exploration of an app's affordances and, on occasion, of at least one tool, and was reminiscent in some ways to Escobedo's (1992) exploration stage in which "children first discover what they can do with the material through exploration and inspection" (p. 125). The re-visiting form was linked with students' seemingly more purposeful approach, either to continue with exploration or to search for something. Properties that emerged around sampling play included short duration, and dimensions of more limited attention, interest, or motivation. Sometimes it was connected with social interactions.

Through the tracking of participants' experiences with each program across the entire study, the data initially revealed that children spent brief amounts of time in certain apps on certain days, and much longer periods of time with other apps (or even the same app). Of the 374 incidents in this study, 44% (166) lasted for 60 seconds or less, 20% (74) lasted for 61—120 seconds, and 36% (134) lasted for over 2 minutes. Because such a large portion of incidents lasted sixty seconds or less, I began to investigate the short incidents more closely, and from this examination, properties of sampling play emerged. Wang & Ching (2003) also included a temporal coding category for children's computer play. I examined those incidents of 60 seconds or shorter duration, from app opening to closing. I continued examining incidents lasting from 61—120 seconds, and found additional examples, indicating that a specific (short) amount of time could not be the only indicator of sampling. I began to look for additional indicators such as student interactional styles, personal preference, and social influences.

During initial analysis of the data, the notion of sampling at first seemed linked to individual students' interactional styles—it seemed certain students preferred to try many things, jumping from program to program, staying only briefly in each one, while other students tended to try out only a few apps and/or tools, preferring to engage for longer periods with particular apps. However, after charting how many minutes each student stayed in each game during each visit, data revealed that all students engaged in brief app visits from time to time. In order to explore this phenomenon, I sorted the original 129 incidents and found 68 incidents examples of short program engagement (2 minutes or less). I then looked through the rest of the participants' timing charts, reviewed these incidents, and looked for properties of sampling by each child in the study. While each student engaged in the phenomenon of sampling, the incidents indicated variation both between and within individuals' actions. Comparing individual incidents to each other across time—from the same student and between different students—indicated additional dimensions of the sampling approach.

In the current data set, there were several actions that emerged as indicators of sampling, including children's choices and actions around: program content, various gestural moves; tool uses; and object manipulations. In the following subsections I explain and give examples of characteristics that emerged around sampling with open-ended iPad apps: exploring program content, exploring gestural moves, and exploring tools. Additional subsections will follow on some of the conditions that affected students' choices to close their selected program after only a short duration of engagement with an app.

Sampling: Exploring Program Content

One characteristic of sampling included student actions whereby they briefly explored an app in order to figure out what the program was about. The icons representing a program did not always clearly indicate the function of the program. Thus, students often tapped on the icons without much idea of what options a particular program afforded. Following are three incident examples of the sampling property of exploring program content.

For example, during Week Two the following 20-second incident occurred between Juan and Wayne. This was Wayne's second visit to the iPad station and Juan's first.

> As Wayne hovered his finger over the available apps, Juan started scrolling back and forth to different screens exclaiming, "Ahhh, look! I'm gonna get a different…ahhh, oh, aaaack!" I pointed to the first screen indicating that all their choices were on that main screen. Wayne asked Juan what he wanted to play while simultaneously tapping the orange icon for the app *Scribble Press*. Juan, noticing this, tapped open the same app. Both players looked at their screens, which revealed differing shelves of book covers with cartoon-drawn or photographic images. Juan glanced at Wayne's screen and noticed a book cover with a photograph of a bandana and mask-clad boy staring at the viewer, and he pointed to it imploring, "Do this one!" Wayne and Juan both tapped on the cover (on Juan's screen) until it opened and Juan turned back to his own screen, on which a text-based pop-up had appeared. He tapped on a top-left-corner rectangle (imprinted with the word 'cancel') while saying, "Get out!" The pop-up disappeared and Juan scrolled through his "shelves," looked at the different set of book covers and stated, "These are just books. Get out [he taps his iPad home button]. These are just book, Wayne!" He looked over at Wayne who then replied, "Ok," and tapped his home button as well.

In this incident, Juan examined the program content by opening the same app as his tablemate, glancing at his partner's book options, suggesting and selecting a specific image on his partner's tablet. He then returned his gaze to his own tablet images, and after brief examination, closed the program as the "just books" were not an option in which he was interested. He seemed to be sampling the content of the app, and upon finding the content unappealing at that moment, he moved on.

In a second example that lasted for 20 seconds during Week Three, Maya examined her home screen and tapped on the *Fluidity* (2011) icon app. This was her third visit to the iPad station, but her first time to have an iPad all to herself (the first two weeks she shared with another student). It was also the third time she had interacted with this app, but the first time she had done so alone.

> As the program opened and the "liquid" and "bubbles" started moving on the screen, she gently tapped in the middle of the screen twice, then slightly slid her finger about 2 centimeters across the screen before standing up and looking for the volume button on the edge of the iPad. She ran her fingers along the side and the top of the iPad, asking, "How do you turn this up?" I reached over and pressed the volume button and she watched as the volume-up icon appeared in the center of the screen. As I increased the volume and more volume dots appeared, I said, "This one doesn't have sound." She swiped her finger back and forth once across the screen to check and then tapped her home button to close the program and look for another app.

In this incident Maya examined how her finger made marks through the liquid, then looked for the volume button and the maneuver that would produce an increase in sound. After the increased volume revealed a lack of sound, Maya checked the screen once more to determine the available options: to swirl one's finger through the liquid. She observed the light, color, and material movement change, and then closed the program. She had opportunity to examine app content—light, color, movement, lack of sound—and then chose to close the program. It is unclear what motivated Maya to move on to another app, but she engaged only long enough to sample the program before selecting another program.

In a third example, Juan spent 25 seconds in *Draw & Tell HD* during Week Five looking for the available options in the existing line-drawing color pages.

> Juan was initially engaged with the app *Fluidity*, as he sat beside Marie who had just opened *Draw & Tell HD*. About 2 seconds after Marie's program opened and the voiceover said, "Welcome to Draw and Tell," Juan glanced over, pushed his home button and then rapidly tapped his *Draw & Tell HD* icon. As Juan's program opened, Marie scrolled through the line drawings on her screen exclaiming, "Oooh, these are soo….perfect!" Juan impatiently tapped his screen as the introductory voice-over finished, and then tapped the same green icon that Marie had tapped for line drawings. He had engaged with the app the previous week, but had only tapped this particular line-drawing icon for 1 second before exiting by hitting the back arrow. This time, he looked at the screen as the thumbnails of black and white line drawings appeared, scrolling up and down through the choices before tapping the back arrow. He then tapped the red icon, which opened a full page of thumbnails of completed paintings and colored line drawings. He looked through them, scrolled to the bottom and then tapped the pink corner button that had printed on it the word, "delete" and a voice-over sounded, "Pick the drawing to delete." Juan scanned the drawings, hovering his stylus over one of them and then tapped the home button and began looking again at the available app choices on the home screen.

In this example, Juan revisited an app he had briefly visited the week before, examined two of the program features—line drawings and completed drawings—for a slightly longer period of time than in his previous visit, then decided to exit the program.

In each of these examples, examining program content allowed students to briefly explore program content and some possible available tools or app affordances. They could then use this information to determine whether or not they wanted to continue engaging with the app. If they did not, and closed the app, this indicated their "sampling" of the app, rather than their continued engagement.

Sampling: Exploring Gestures

A second property observed in some incidents of sampling involved the exploration of various gestural moves: tapping, sliding, and swirling one's finger(s), hand(s), or stylus. Sometimes students would just try one or two gestures before closing the program, and other times students explored multiple gestural moves. This could be related to Trageton's (2005) notion of sensorimotor/manipulative play, which Trageton notes as an initial stage in any form of play (e.g., role play, construction play, rule play). When children's gestural sensorimotor exploration was brief and exemplified in short program incidents (2 minutes or less) it was associated with playing to sample as it seemed to be a means by which students could explore some of the gestural options available with a given app.

One incident example occurred during Week Two, and lasted for 25 seconds, with participants Juan and Wayne.

> The incident began as Wayne turned to his tablemate Juan and asked about the game he was playing, "Hey, how did you do that? Cat?" Juan confirmed that he was playing the "cat" game—*Draw& Tell HD*—and Wayne tapped open the same program. He looked over at Juan who was tapping the large paint-brush wielding cartoon cat on the left side of his screen. Each time Juan tapped this cat, it waved it's arms and said, "Gaaa," which resulted in giggles and comments from Juan about the "funny…so funny" cat. Juan reached over and repeatedly tapped the cat on Wayne's screen, as he laughed, "Say gaaa," and the cat responded with the arm-waving and nonsense sounds. Wayne pushed away Juan's hand and started slowly tapping the cat with his index finger. He tapped twice in the middle of the cat, then slightly to the side on its arms, then switched to tapping with his thumb, and then back to his finger as Juan watched beside him laughing and saying, "So funny…he's so funny like saying this….(laughing) so funny! Let's get out." Juan then tapped his home screen and looked for another program saying, "I'm not playing this game." Wayne tapped the cat quickly five more times and then closed his program as well.

In this incident, Wayne used tapping gestures with different digits, at differing speeds, and in slightly different areas on the screen, watching and listening for the "funny" response before his gestural exploration was complete and he followed his friend into a different game. He explored various gestures during his brief sampling of the program before following the choices of his tablemate.

Another example, during Week Five, lasted for 10 seconds. Juan, called over to the table by Marie, sat down at an iPad already swirling with the colorful bubbles and liquid of *Fluidity* (2011). In his three previous visits he had not yet opened or engaged with this app.

> Juan reached out his index finger and swirled in a circle, and then slid it across the screen in straight lines, almost in a star shape. An onlooker urged him to use the stylus, "No, Juan, this one…the pen" and Juan picked up the stylus with his right hand, squished the soft tip against his left palm, and then swirled it against the screen twice clockwise and twice counterclockwise before tapping the home button to choose a different program.

Juan briefly explored gestural moves with his finger, then briefly explored the squishy stylus, then briefly moved the stylus across the screen. The particular sensorimotor exploration with the stylus itself occurred with most students' initial use of the stylus. Moves included examining and squishing the soft tip, pushing it against one's finger, hand, or even face, in addition to moving it across the screen. Juan's gestural explorations included brief moves with his finger, manipulation of the stylus alone, and then manipulating the stylus against the screen before he closed the program and searched/found the app with which his tablemate Marie was engaged.

In longer examples of the gestural exploration property of playing to sample, children explored with multiple gestural moves for a more extended period of time. During Week Five, Simone tapped open *Pocket Pond* (2012), a game she had played 8 times over her previous visits, and often for a longer duration of time (up to 2.15 minutes). In this instance, however, she only explored with gestures for 40 seconds before closing the program.

> As the program opened, Simone rested her chin on her hand, and swiped her left index finger through the water, and paused to watch the dragonflies flit about as fish swam under the existing lily pads. She looked across the screen and then swirled her left index finger in a circular motion clockwise, counter-clockwise, and then zig-zagged through the water before opening her palm and tapping at the "water." Without pulling her hand away, she then altered her hand back to open-handed single finger and then closed-handed index finger as she swirled in a clockwise motion across the screen. She swiped back and forth and then picked up the stylus, looked at both ends and then turned the squishy side toward the screen and continued to swirl in a clockwise circular motion across the screen, resulting in rippling water and gurgling sounds. She then leaned back, took her hand off her chin, continued swirling the 'water' and asked, "What are…what are those dragonflies for?" Her tablemate, Wayne, playing a different game, responded, "Because, because they are doing…" Simone moved her stylus in a large, slow, circle and then more rapidly as she saw fish swim across the screen, "Ooh, FISHIES!!" She moved her stylus in rapid strokes at the fish, tapped repeatedly near them, and then slid her stylus from side to side in quick, uninterrupted strokes. Next, she put her stylus down and rubbed with both hands on the screen, wiping back and forth, then quickly altering again to swiping in short strokes with a single finger. After this, she reached up and tapped the home button and rested her chin back on her hand.

In this incident Simone used multiple gestures (swirling, tapping, sliding), differing hand positions (open-palm, extended digit), explored with single and double-handed movements, and tried stylus-based moves as well. She explored these various gestural moves as she interacted with the "water" and "fishies" and watched the responses before closing the program. Simone sampled several gestures in this program, observed the response, and then moved to a different program.

In each of these gestural examples, students tried various finger and hand movements and watched the consequent reaction on screen—possibly a form of Trageton's (2005) interpretation of Piaget's sensorimotor play. Whether trying only a couple of moves, or multiple moves, the duration of gestural exploration was short before the student decided to close the program. In these instances, students sampled possible gestural moves and the consequent program responses.

Sampling: Exploring Tools

In addition to sampling program content, and sampling gestures, students also evidenced sampling tool affordances. Tools included items such as stamp-like-objects, pens, paintbrushes, pencils, backgrounds, patterns, colors, audio and screen recording tools, and various types of erasers. These tools were represented by a variety of icons, most of which were images only, but some of which included both image and text. During shorter incidents, a child might manipulate only a single tool, and in longer instances of the sampling approach they might engage an additional tool before closing the program.

One Week Two example occurred when Maya visited the iPad station for the second time (seated beside Lela). Maya spent 25 seconds sampling the painting tool in *Doodle Buddy* (2011).

> After spending 10 seconds swiping purple paint on the screen in *Doodlecast*, she stopped abruptly and said, "Wait," as she pushed the home button and scanned her finger across all the home-screen program options, saying, "I think I wanna doooo…." She tapped on the *Doodle Buddy* icon, then tapped the loading image to which her partner Lela said, "Wait, you have to wait." The program opened to reveal an earlier player's drawing of a yellow sun and a blue flower with pink petals. Maya touched the screen just to the right of the flower and a yellow dot of paint appeared. She continued sliding her finger to complete a jagged rectangle and then reached up and drew a yellow circle with lines (a sun) parallel to the existing one. I asked if she wanted to erase and she said, "Noo…" as she completed her sun. She then reached over and colored in the center of the flower with yellow, and began coloring over each petal as Lela reached up to color in both suns. She then tapped beside the flower and said, "Wait, I think I wanna do…" and tapped the home button to find another program.

In this incident, both Maya and Lela sampled the painting tool by adding color to an existing drawing. This exploration occurred not as a result of Maya's specific selection of the paint tool, but rather because the tool was already engaged by a previous player.

In a second example, Sofia explored with tools for 35 seconds in her first experience with *Doodlecast* (2012) during Week Two.

> Sofia tapped on the app icon and the program opened to a screen filled with two purple circles, traced and filled in by an earlier player. She circled her index finger on the screen and then swiped back and forth, coloring in the top middle portion of the screen with purple 'paint'. Her tablemate asked, "Where is that?" and Sofia reached over and pointed to the *Doodlecast* icon on his screen and tapped it open for him. However, his looked different as it was filled with a red and purple shopping cart traced by an earlier player, and a paint-color palette was popped-open along the side. She started to tap her tablemate's home button to close the program but her tablemate pulled her hand back and she said, "Wait…(noticing the color choices) what color, blue?" She tapped the blue square, and her tablemate said, "Yeah." Sofia turned back to her own screen, and noticed the black record button and grey volume lines in the bottom left-hand corner and began tapping at these icons. She first she tapped the black dot, and a pink rectangle with the text "record" popped out. She tapped on the word and the black dot turned red and the grey lines below it began to light up green. She tapped the dot again and a blue rectangle with the text "pause" popped out. She tapped on the word and the red dot turned black and green lines turned grey. She reached back over and swiped a little more color on the screen before reaching to the home button and holding her thumb there for a few seconds before pressing the button to select a different program.

Sofia explored with the already-engaged painting tool, tapped a color on her tablemates already-engaged paint palette, and then sampled the recording/volume icons, watching for the result. Because the icons were very simplistic shapes, and some included text she couldn't decipher, her tool exploration lacked control that she might have had if the icons had been more easily interpreted by her. Her sampling of this program occurred for 35 seconds before she closed the program.

In each of the tool explorations, students touched the screen to see the response from an already engaged tool, or they selected specific tools and engaged in exploration. On some occasions, students might only engage one tool, and on other occasions they might engage several tools. However, the tool engagement only occurred for a short period of time—just long enough for students to briefly sample—before their engagement with the program ended. Each of these properties—exploring program content, gestures, and tools—were associated with students' sampling a given app's affordances for a short duration of time. Such exploration of program affordances and tools can be connected to Escobedo's (1992, 1999) descriptions of children's exploratory actions for the purposes of discovering a computer program's capabilities. Labbo (1996) also noted exploratory manipulation of tools, which she defined as "pre-object" play that was necessary before children could engage tools in meaningful ways. I argue that these actions seemed to indicate simultaneously a form of manipulative and sensorimotor play, akin to Trageton's (2005) adaptation of Piaget's (1962) conception of sensorimotor play. The type of manipulative play in this study seemed to be a means by which students could explore an app's affordances, but sometimes also resulted in students' actions to navigate through difficulties.

Summarizing Sampling of App Content, Gesture, & Tools

In all of these sampling-approach examples, the children explored one or two particular features—program content, gestures, or tools—but only for a short time. In addition, sampling seems to be connected in some way to issues of attention, interest, and motivation. Other studies have noted children's explorations of tools (Escobedo, 1992, 1999; Labbo, 1996) but have not included children's explorations of program content or gestural moves. This study allowed these properties to emerge due to the inclusion of multiple apps and of a computer that allowed multiple gestures with both hand and device (stylus) on an interactive touch-screen. Furthermore, throughout incidents of students' sampling of content, gestures and tools, students did not appear to have a goal of completing a design—no completed images were observed during these incidents. Nor did students' actions reveal more sustained attention or deeper interest. Instead, the students seemed to be only briefly exploring the program affordances, tools, and possible gestures before moving on to another program. The characteristics of sampling included exploring program content, gestures, and tools. When students engaged in actions connected with longer program-incidents, they appeared to move into a different type of engagement: playing not to explore, but rather to delve more in depth with experimentation and creation.

Experimenting: Manipulative Play for Testing, Practicing, Creating

In addition to sampling app content, tools, or gestures, a second type of approach in which students engaged during their experiences with open-ended iPad apps was experimenting. Experimenting was observed by all 14 participants in the study, and was observed in 67% (253 incidents) of the total 374 incidents. Compared with sampling, experimenting seemed to be more extended in duration. Experimenting also seemed to be connected with students' more sustained attention, their deeper levels of interest, and their movement toward creating something. It can be connected with previous research as it seems to align in some ways with Escobedo's (1992) "manipulation and experimentation" phase, in which children were found to have "gained better control of the computer and had experimented with it to produce shapes and forms" (p. 126). In the current study, students' more sustained interactions with a program (with a duration of two minutes or longer) indicated several properties linked to this type of manipulative play. When experimenting, children tested tools, practiced with them, tried different gestural moves, and sometimes demonstrated not only tool experimentation, but also composition creation. Students evidenced stylistic differences in their testing and practice, including either methodical or more seemingly random practicing styles. When their actions indicated some form of composition, both representational and non-representational imagery were exemplified. In the following sections I explain these properties of experimenting with open-ended iPad apps, including testing, practicing, and composing.

Experimenting by Testing & Practicing

One property of experimenting included various types of testing actions. Testing actions appeared to include students' scanning of media choices, deciphering of icons, and experimenting with specific tool manipulations and gestures. Testing usually led to practicing moves—repeated use of a tool—and sometimes led to creation of a composition. Experimenting via testing usually occurred during students' early experiences with a program, though not always as some programs had many features and tools. Some tools were discovered even after much experience with an app, and this discovery of new tools often elicited some testing behavior. The following examples include both tables and narrative explanation of student engagement in testing behaviors that then evolved into subsequent practicing and/or deliberate creation.

In one example during Week Two, Marie was seated beside her friend Vera and both were engaged for the second time during their second visit, with the app *Doodle Buddy* (2011). After a few moments of interacting with Vera and with me on how to change the background color, Marie began to test the drawing tools available in this drawing program. Table 6 includes a description of her testing actions, including her choice of program icons, gestures and program responses, and her verbalizations.

Table 6

Marie's Experimenting via Testing: How to Add Color in Doodle Buddy (2011)

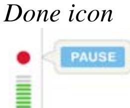
Week, Time, App	**Icon & Function**	**Student Gestures & Program Responses Within Relevant Context**	**Student Verbaliza-tion**
Week Two 3:25 – 3.52 (27 seconds of 7.50 total time in app)	 Choose Color	Scans icons and taps on the "chalk" icon.	
 *Doodle Buddy*	 Palette	A palette with many colors and other media tools appears. Marie looks at the palette. Leans back in chair and bounces feet up and down.	Gaaa!! Rainbow!
	 Glitter Tool	Reaches and taps glitter icon for the glitter tool. The palette disappears.	
	 Pink Color	Taps chalk icon again and palette reappears. Marie taps pink square.	
		Marie slides her index finger back and forth across the screen and pink-glitter marks appear.	Glitter!!
		She continues swiping finger back and forth from side to side across the screen, coloring long swaths of color across the middle of the background.	Pink glitter. Glitter!!!!
		Vera leans over and looks at Marie's drawing screen and says, "Do you know that is black? Glitter?"	That's pink black with it mixed up.
		Marie erases her screen and then begins swiping color across the screen again.	I'm gonna do it all… with the glitter.

In this example, Marie scanned the tools and selected one—the chalk tool—which she discovered to be the portal for the palette of media choices (paintbrush, chalk, glitter, smudge, and eraser), as well as color choices represented in the "rainbow" color spectrum. The palette included icons for each of the tools, the color spectrum, squares indicating previously selected colors, and for multiple sizes of brushes/erasers. She then had to interpret how to read the variety of choices on the palette. She tested the tools of interest to her: the glitter tool and the color pink. She then moved her finger slowly across the screen watching for the result and exclaimed her excitement at the program response to her finger-swipes, "Pink Glitter!!!" However, on screen the glitter was not shiny and light reflective as is real glitter in physical space. Marie's partner, Vera, leaned over and "read" the glitter as perhaps different to real glitter, "Do you know that is black…glitter?" Marie confirmed that it was indeed glitter but explained that this type of glitter was "pink black with it mixed up." Marie tested four icons (chalk icon, palette icon, glitter icon, pink-color icon) and two gestural moves (tapping and swiping) in order to figure out how the program worked and how she could manipulate the tools. She then expressed her objective to color in the entire screen with pink glitter, "I'm gonna do it all…with the glitter." After this 27 second testing period, she then spent over 2 minutes coloring in the entire screen until it was covered with pink "glitter," practicing with the tool and creating a non-representational creation. Her testing actions of choosing tools, deciphering multiple icons, trying specific moves, and watching for the program responses enabled her to understand the program well enough to then practice with the tool and create a non-representational image of a pink-glitter paint-filled screen.

In an example with a different program, *Doodlecast* (2012), Juan tried multiple icons. The following example took place in Week Five during Juan's fourth visit to the iPad station and it was his second time to engage with this app.

Table 7

Juan's Experimenting via Testing of Icons in DoodleCast (2012)

Week, Time, App	**Icon & Function**	**Student Gestures & Program Responses Within Relevant Context**
Week Five 17:55—19:25 (90 seconds of 3.50 total time in app)  *Doodlecast*	 *Clear icon*  *Text pop-out*	Juan slides the stylus in an elongated unclosed purple swirl in the middle of the screen and lifts the stylus. (Figure 5, Image A) He notices the icons along the left side and hovers his stylus over the choices. He taps the X icon. A text pop-out with the word "clear" appears. He taps near it, jabs twice back on the screen near the existing squiggle. Two dots appear. He taps the red X again, tries to slide the text pop-out over. He taps twice more, before accurately tapping inside the text pop-out. The screen clears, and a purple dot appears.
	 *Done icon*	He again taps the red X, then near the purple triangle (done icon). He taps just outside the purple triangle and purple dots appear. He begins to slide his stylus all around the screen, lifting it only once to add a straight line near the bottom. (See Figure 5, Image B)
	 *Record icon & Pause text*	He reaches over and taps on the red record button and a text pop-out with the word "pause" appears. He taps it then taps on the screen and draws a few more lines.
	 *Timer icon*	He taps near the greyed-out record button and then taps at the timer icon and slides his stylus down. Another purple line appears from the timer. He draws a few more lines.
	 *Record icon*	He hovers his stylus over all the choices on the left side and taps the greyed-out record button and taps the "record" text pop-out. He starts to draw another line and then sees the green audio lines lighting up so he taps at them. The "pause" pop-out appears again, he taps it, and then swipes more color on the screen. (See Figure 5, Image C)
	 *Eraser icon*  *Eraser widths*	He taps at the record dot again, pauses, then taps the erase icon. Three wavy lines pop out and he taps the largest and swipes his stylus across the screen. The swipes erase the picture and he erases most of it manually before tapping several times at the icon bank and tapping the red X and tapping "clear".
	 *Paint icon*	Juan looks over at Marie and sees her tap her paintbrush icon and select a color. He turns back and taps his paintbrush icon.
	 *Color icons*	A palette of colors appear, he taps red, and begins to draw a new design in red on his screen.

After spending a few seconds opening the program and navigating to a drawing screen, Juan began to test many of the icons along the left-hand side of the screen. Table 7 includes the icons he tested, his actions, and the program responses, and Figure 5 displays three screenshots of his drawing while appeared to test these different icons. No language is included because Juan did not speak during this activity.

Juan began by drawing briefly on the screen (see Figure 5, Image A) before seeming to notice several icons along the left-hand side of the screen. As indicated in Table 7, Juan navigated through three icons (clear icon, text pop-out, done icon) before intentionally adding more marks (see Figure 5, Image B), and then through three more icons (record-pause icon, timer icon, record-record icon) before adding a few more swipes of purple color (see Figure 5, Image C). He then navigated two more icons (eraser icon, eraser-width icons) before manually erasing his picture using the eraser tool, and then using the clear-icon to erase the last few marks. Throughout his 90 seconds of testing actions, Juan figured out how to

A B C

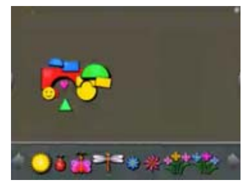
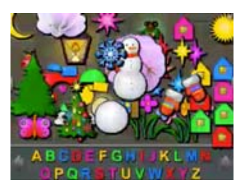
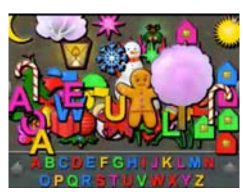
Figure 5. Images A, B, C from Juan's Testing of Icons in *DoodleCast* (2012)

draw on his screen, clear the entire screen, select the eraser and erase his color manually, and also to select the paintbrush tool and change colors. He happened to also turn the recording function on and off repeatedly, by tapping the red recording indicator, then tapping the word "pause," and tapping the greyed-out recording indicator followed by taps on the word "record." In addition, he tapped at the green audio indicator lights and watched for any response. After his 90 seconds of icon testing, Juan spent the remainder of his time in this app practicing drawing, observing Marie learn how to play back one's drawing, tapping the appropriate icon to watch a partial playback of his own drawing, and then practicing more with drawing and erasing.

In this example, Juan tested 12 icon/tool combinations (X/clear, "clear"/clear, triangle/done, red circle/record, "record"/record, grey circle/pause, "pause"/pause, grey/red circle/timer, pink rectangle/eraser, wavy lines/eraser widths, brush/paint icon, multicolored squares/paint choices). In between some of these tests he swiped more color on the screen, but he did not seem to focus on the content of his drawing. Instead, he seemed to be testing the icons and what tapping them might reveal. Most of these icons, however, when tapped, revealed a text box with a single word of explanation. Fieldnotes indicated that Juan was not yet a conventional reader, so the print directives weren't followed, Instead, Juan used tool-testing gestures, including taps on an icon, swipes of a stylus, looking for program responses, and then repeating this pattern. Juan appeared to use "try and check" (trial and error), tapping, moving, and watching for response. Later, he practiced drawing, changing colors, and erasing with these previously tested moves. But there is no evidence that he realized his tapping of the recording indicator and associated text icons was engaging and disengaging the recording feature. After the 90 second testing moves described above, he spent time practicing the successfully learned actions of how to select color, add color, erase color, and clear the screen.

Table 8

Sofia's Practicing for Extended time in ABC Magnetic Board (2012)

Implement/Gesture	**Resultant Image**
Using fingers, she touches and slides an arch block to the left of the screen, and then successively slides over a blue rectangle, yellow circle, red heart (then repositions it), red square, green triangle, blue half-circle, yellow arch, yellow smiley face, green half-circle, yellow rectangle. Stops to listen & watch Will for a moment, then to Holly and other students chatting. She turns back to her own screen and sees the arrow button and taps forward arrow 3 times, back arrow 4 times. The magnet choices scroll from night set through cake set, tree set, Christmas set, tree set, cake set, night set, to flower set. She stops at the flower set, points and says, "Oooooh!!" She stands up and leans over Holly's computer, "Look at your computer!! Look at your computer!" Holly is helping Will erase so Sofia implores a nearby student to look. She then leans over and looks at the computer screen, then sits down and slides up a pinwheel-flower, taps the bottom pinwheel flower again and then slides up an orange one, then slides up two sets of daffodil bunches. She begins moving methodically through the choices adding from right to left a blue small flower, a dragonfly, pink butterfly, red ladybug, and yellow sun which she then moves to the right hand side of the screen. "Sun!" (She then taps the arrow key and adds more and more items.) … (She continues to practice adding icons from many different magnet sets)… After 8 minutes she has completed one screen full of many magnets.	         

The two experimenting through testing and practicing examples given thus far were shorter elements of a longer play incident. However, there were also longer examples of the property of practicing, wherein students practiced for an extended period with a specific tool or with multiple gestures. Another type of practicing activity included repeated engagement with one tool for an extended period of time. In one example that occurred during Week Two, Sofia, who was an iPad novice, practiced adding magnets for eight minutes in *ABC Magnetic Board* (2012) for the first time. The app opened to reveal a screen of magnets arranged by a previous player, and she began manipulating these magnets (See Table 8). While her placement of magnets was careful at first to fill empty spaces, she soon ran out of space and began piling magnets on top of one another. Her goal seemed to be to try out the many possible magnet choices rather than to create a specific image or design.

In addition to experimenting through practice with tools, students also experimented through practice with gestures, especially in apps with fewer tools, such as *Fluidity* (2011), and *Pocket Pond* (2012). In the *Fluidity* (2011) app, the screen is filled with rising bubbles and morphing colors, and finger gestures can produce both bright light and movement of the 'fluid.' The colors rotate through a pattern regardless of what gestures are made. Some students experimented with this game for extended periods of time while others tried it only briefly or ignored it altogether. Those who stayed with it often tried a variety of gestures, from individual to multiple fingers, single or double-handed, with fingers or stylus, and using a variety of swipes, pats, swirls, and taps.

In a slightly more complex game, *Pocket Pond* (2012), the screen flickers with simulated water, and any movement of finger or stylus on the screen results in a splashing sound and the appearance of water movement. Fish eventually swim across the screen and could be re-directed off screen by touching the 'water' anywhere near them. This game also allows the user to add more fish, lily pads, dragonflies, and fish food by pressing an icon that opens to the choice palette. However, many students did not discover this feature, as the icon was a very small, white plus sign (+) in the top left-hand corner of the screen. Many students played this game on multiple occasions, and often spent most of their time waiting for fish, tapping at fish, and trying multiple gestures through the 'water,' and trying to scare the 'fish'.

One example of a student practicing with multiple gestures in *Pocket Pond* (2012) occurred during Week Three as Glenn, who was also an English language learner, visited the iPad station for the first time and spent 18 minutes playing with this app, trying multiple gestures, and even trying to entice his tablemate to try the app. In the beginning, he made moves to agitate the water and watch the response, but after a few seconds he began waiting for fish, and then, and gesturing to "scare" the fish (he later vocalized this goal) by agitating the water at or near the fish. He used his hands in various formations, sometimes using a single hand, other times both hands (see Figure 6). He also used a variety of finger combinations, including index fingers, thumbs, or four fingers on one or two hands. His moves included careful taps, small and large swirls, single and double-handed z-shapes, rapid jabs, short rubs, slow and fast slides, pinches, and double-handed cross-chops. The images in Figure 6 from left to right represent the following gestural moves: closed tap, double-finger tap, thumb slide, thumb and finger slide, cross chop, double-finger jab, double-thumb slide, and pinch.

The examples in Figure 6 are just a few of the many hand positions and gestures Glenn experimented with in his 18 minutes of play with Fish Pond in this one sitting. During the first 5 minutes of his interaction with the water and fish, Glenn did not speak other than to ask for assistance to remove a pop-up, "Hey, I cannot do this thing," and "Hey can you put it back on?" But after 5 minutes of trying multiple moves, he began to make more verbalizations that seemed to indicate a move from experimenting/practicing to engaging in pretense (a finding to be discussed in a later section). As he tried his different moves to tap at the fish, he began to make comments including, “Yeah, I got it, I got it!!” and “Hey, I have to get it!” This drew the attention of his tablemate, Tony, who then opened *Pocket Pond* (2012) on his iPad. Glenn explained how to play, “Remember the fish gotta caught.” He went on to tell Tony that he should, “Press fish.” Both boys began to experiment with many gestures, and they talked to the fish and made sound effects as they tapped and swiped. At one point, Tony announced his newly invented gestural move, “I’m doing this,” as he circled four fingers rapidly through the water, “so the fishes can go away.” Glenn then picked up the same move, though he only used one finger to circle through the water, and did so more slowly saying, “I try this. . . I try this.” Both boys continued to try many moves and even added more objects until Tony left after 4 minutes and 40 seconds. Glenn stayed after Tony left and continued to try many moves to “get the fish.” He engaged with the game for over 18 minutes. Glenn’s gestural moves and accompanying language seemed to be linked to both manipulative and pretense-related play.

Figure 6. Glenn’s Gestural Practice in *Pocket Pond* (2012)

In contrast to trying many varied gestural moves, some students experimented through repeated practice with a single newly-learned gesture. For example, when playing *ABC Magnetic Board* (2012) during his second visit in Week Three, Juan looked up when I mentioned (and showed by moving my hand in the air) that a pinching gesture would shrink the size of the magnets on screen. Juan replied, "I know how to make it smaller," and then used two hands (his left thumb and right forefinger) to shrink all the objects on his screen as he said, "I'm making all of them smaller." He then continued to add more objects and then shrink them (eventually altering to using both index fingers) exclaiming, "Pinching it. Pinching it. I'm pinching it tiny. Popsicle!! Pinch it." His tablemate, Will, also took up pinching (using one hand with forefinger and thumb), and echoed Juan's words as he pinched his objects, "Tiny!!" Both boys took up this gesture (Juan with two index fingers and Will using forefinger and thumb) and practiced it repeatedly with many magnets. Once discovered by other students—whether through a suggestion by a tablemate or through seeing another's use of the strategy—the pinching gesture was often a single practicing move taken up and repeated often by players.

Finally, when provided with a new physical tool for manipulating objects on screen—a stylus—students often took a few seconds to manipulate the stylus itself either before, or briefly in the midst of using it to manipulate objects on the screen. For example, during Week Four when the stylus was introduced for the first time to Sofia and Wayne, both of whom indicated they had not used a stylus before, they alternated between drawing and briefly exploring the stylus itself.

> As a form of introduction, before handing a stylus to each of them, I held one up and explained, "I have some pens that you can use on the iPad today (Sofia gasped with excitement), but I have to tell you two things. The first thing I have to tell you is: you use the squishy part [I pointed to the soft, rounded tip] to write, like this [I reached over to swipe back and forth on Wayne's screen]. . . And the second part is: use gentle hands. So you can't bang it like this [I imitated a

jabbing motion in the air]. You have to use gentle hands [I demonstrated smooth circular motions in the air]. Do you want to try?" Both Wayne and Sofia quickly reached out and grabbed for a stylus. Wayne immediately positioned it in his right hand, using a pencil grip, and swiped it across the screen, while Sofia grabbed hers, looked at the squishy tip, then hovered it over the *Doodle Buddy* icons for a moment. Wayne's swipes did not elicit any lines drawn on the screen, and he said, "It doesn't work," and rested his right hand (holding the stylus) on the table and used his left thumb to begin tapping and manipulating objects on the screen. He and I talked briefly about how to switch from the eraser to a drawing tool and he explained his desire to remove the beach background from his *Doodle Buddy* screen. I explained how he could change the background and he used his thumb to accomplish his goal of changing the background, choosing a color, and choosing the glitter tool. He then began to draw on the screen with his stylus. He spent the next 70 seconds alternating between using his fingers to select icons and tools, and to erase, and using the stylus to draw. He even adjusted his hand position while drawing so that he could rest the heel of his stylus-hand on the screen as he drew. After about 70 seconds of alternating between using fingers and his stylus, he figured out how to erase with the stylus and as he swiped the stylus back and forth across the screen he exclaimed, "Ooh, look at this! I'm erasing it going like this!!" After erasing his screen using the stylus, he then began using the stylus for all his moves—both for selecting icons and tools, as well as by "painting." He stopped after 2 minutes and 20 seconds to examine the stylus, looking at the tip, pressing in and testing both ends before resuming his color selection and color adding via the stylus.

During this same time period, Sofia used her stylus to tap on the chalk icon and select a new color (yellow) and then tentatively made small marks of color at the bottom of her screen, saying excitedly, "Look, Wayne!!!" She continued to color in an area at the bottom of the screen using small, controlled swipes, then tapped dots on the top left corner. Next, she pulled her stylus back and started squishing the tip repeatedly with her left finger asking, "Ah, this is the squishy part?" She used the stylus to tap the chalk icon, select a different color, and resumed swiping color on the screen. As she continued choosing colors and adding them to the screen, she stopped twice to push in the squishy part with her finger, then returned to using the stylus for all her actions. She even stopped for a moment when she saw Wayne swipe quickly and reminded him, "Hey, you can't rub it too hard." She continued using the stylus, holding it with a pencil grip, for all her actions: selecting icons, selecting tools, adding color, and erasing. When she discovered how to erase, she laughed and said, "Awesome…Look, Wayne!!" Her stylus moves removed the blobs of paint she had added, but it did not remove the beach background from her image. After swiping three times at the background beach umbrella, she then moved her stylus to a white space on the screen and began to tap at the screen. She then slid the stylus down slowly over the umbrella and

> began to sing, "Why's it not gonna work, why's it not gonna work, I don't know it's not gonna work. Why's it not gonna work it isn't, why's it not gonna work." She used the stylus to erase the existing blue, yellow, and red marks she'd added earlier, but it still was "not gonna work" to erase the background beach umbrella (which was designed to look "drawn" rather than a photograph).

In both Wayne's and Sofia's initial stylus experiences, each took a brief moment (albeit at different times for each) to examine the stylus itself. Each also got excited when they realized the stylus could be used not only to add color, but also to erase it. Sofia quickly acclimated to using the stylus for all her actions while Wayne took a little longer (only about one minute) to gain enough control with the stylus to use it for all his moves. These two students' responses with the stylus are two representative examples of students taking time experiment through testing the stylus itself, and then practicing with it in ways that allowed them the highest amount of control.

In the current study, students' tablet-based experimenting included testing and practicing with various tools (e.g., paintbrush, chalk, glitter, stamps, magnets) for varying purposes (e.g., adding, removing, or composing with colors, patterns, shapes, or images). Other times, their experimenting included trying multiple gestures, through which they could practice manipulating on-screen objects (e.g., water, fish, fluid, magnets). Varied gestures or repeated single gestures were taken up in relation to students' experimentation with how to play the game (e.g., how to scare the fish, to make magnets tiny, to record and/or save a show, or to move liquid). Children engaged in these experimentations in stylistically varying ways, from more methodical approaches to seemingly less ordered ones—a characteristic I have not yet uncovered in the literature.

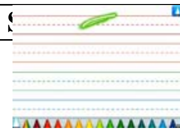
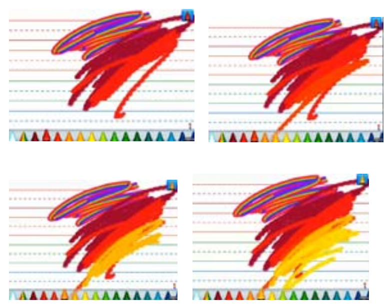
Experimenting Via Methodical Practicing Actions

Students' experimenting through practice with program tools and icons occurred in some instances in methodical ways. Practice was coded as "methodical" when a student's actions indicated repetitive patterns that seemed to occur in an ordered progression. One example of methodical practicing behaviors occurred during Lela's Week One visit to the iPad station. When Lela, an experienced iPad player with an iPad at home, tapped open *Draw & Tell HD* (2012) for the first time, she spent 40 seconds engaged in the following actions: opening the program, adjusting the volume, exploring the choices, choosing a background paper, and tapping icons to scan available tools (all the while, dancing as she did so). She then tapped on the crayon icon, examined the choices, and for the remainder of her engagement with the app, began trying out colors, methodically moving one by one, from left to right through the colors by first selecting a crayon, swiping a bit of color on her "paper" and then moving to the adjacent crayon (see Table 9 for her actions and associated screenshots). These practicing moves (tap color, swipe on screen, move to next color) seem connected to her final non-representational creation, though her goal did not seem to be to make a picture or specific representational design, but rather to experiment and practice—in a methodical order—with multiple colors available through the crayon icon.

I observed type of experimenting through methodical practicing with tools was in other incidents as well, in which students selected colors, objects, or tools in a methodical left-to-right, or top-to-bottom progression. While still in a testing through methodical practice mode students, seemed less interested in making a specific design and more focused on experimenting with a tool's functions and capacities.

Table 9

Lela's Methodical Practicing in Draw & Tell HD (2012)

Student Choices and Gestures	**S[illegible]age**
Using her index finger she taps the far-left crayon (white) twice. The speaker emits a glockenspiel glissando each time she taps the white "magic" crayon. Slides her finger back and forth across the top of the screen. White with green outline appears (but stalls b/c her finger tapped another button inadvertently).	
Reaches down and twice taps the crayon just to the right of the first one—a rainbow crayon. Reaches up and swipes her finger across the screen on top of the green color. She sits back, turns to Holly, points and says, "Rainbow!" Smiles.	
Reaches down and taps next color (maroon) and swipes finger just below rainbow scribbles. Maroon scribbles appear just below the rainbow color.	
Reaches down and one at a time adds a few swipes of red, two shades of orange, then yellow—carefully going in order of the colors across the bottom of the screen. Red, two orange shades, & yellow swaths of color appear in succession.	
Reaches down and touches then slides to the left the crayons and sees the choices slide over. Looks at the choices. Reaches down again and swipes left and watches to see if more choices appear—none do. Taps brown, swipes color, black, swipes color. Reaches back to the left and taps purple, swipes color. Each color appears and then she looks at it. Pushes the home button.	

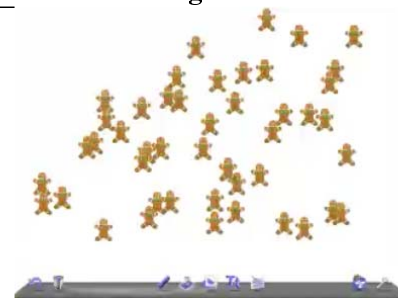
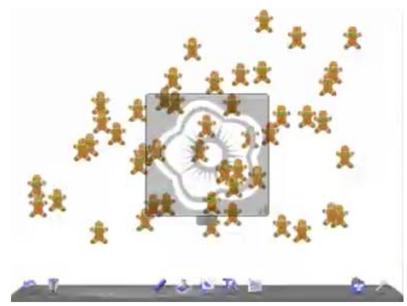
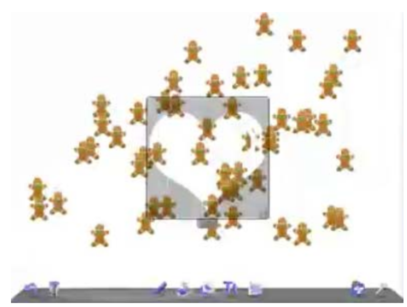
Experimenting Via Less Ordered Practicing Actions

There were also instances in which students engaged in practice with tools in a less ordered, seemingly more randomized fashion. During a Week Five example, Juan used a less methodical style as he practiced adding stamps. He had followed his tablemate in opening the app *Doodle Buddy* (2011) (see Table 10). Even though Juan engaged in repeated actions (adding stamps and covering them with different stamps), his practice appeared less methodical and ordered than that of Will, his tablemate, whose moves Juan followed. He added gingerbread stamps, for example, and then, like his partner, wanted to erase and add different stamps. However, he had more difficulty in navigating the icons and finding the stamps than Will did. When he couldn't seem to figure out successful moves, he quit the program and tried an app he might have felt he had more control over—*ABC Magnetic Board* (2012). He was quickly drawn back to the original app when he saw and heard his partner, Will, getting excited and so once again he tried tapping at icons in the *Doodle Buddy* (2011) app until a new interest (stencils) seemed to capture his attention for a moment. A quick point and a few words of explanation from a knowledgeable other (I explained about and pointed to the icon that would help him add stamps) helped him realize his goal of finding more stamps, and he again tapped them all over the screen, soon "covering all of them" just like his partner.

Juan's less methodical experimenting occurred within a context that evidenced his interest in following his partner's leads, his difficulty navigating program icons, his brief testing actions with stencils, and his continued practicing with the stamp tool after receiving a little assistance from me. Later in this same session he added stamps adroitly, and continued the game he and his tablemate had spontaneously created of tapping stamps and then covering them with other stamps.

Table 10

Juan's Less Ordered Practicing with Doodle Buddy (2011)

Implement/Gesture	**Resultant Image**
The program opens and Juan first slides his stylus across the screen but sees only one gingerbread man appear. He counts, "One…" then repeatedly taps more all around the screen, "…two, three, four, five, aahhhhh!!" With each tap a gingerbread stamp appears and the speaker sounds a steel drum ding. Juan laughs. He continues until nearly 50 gingerbread men have been added.	
He looks at his screen and says, "Ahh, I'm going to erase." He taps the stamps, then stencils, and nothing erases. "Hey, get out of here!!" He taps the home button, then taps the icon just to the right of the *Doodle Buddy* app and *ABC Magnetic Board* opens to a snowy scene. He starts singing and drags up a candle icon, shrinks it, and then looks over to see Will tapping fish on top of his scuba stamps in *Doodle Buddy*. Juan presses his home button and asks, "How did you get that one? How did you get the snowman?" Will doesn't answer. Juan begins jabbing at icons looking, and a tap reveals the stencil palette. He taps on a flower silhouette and the outline appears on the screen. He tries swiping on top of the outline and inside it and around it and it disappears. He taps again on the screen and then tries the stencil palette again, this time trying to slide the flower off. His stylus taps outside the palette and it disappears. He taps the stencil icon a third time and taps on a heart silhouette and a heart shape appears. I reach over to explain how he can add shapes using the stamp icon. He taps 3 more gingerbread men and then when the stamp palette pops up he selects a green smiley face.	 
He taps green faces all over the screen, singing and talking as he begins to tap the smiley faces on top of the existing gingerbread men. "EEe, get it all the way!! Da-da-daaah, dadada-dadaaaa, da da daa. I'm covering them all, ha ha, dad a da daaa da daaa…I'm covering all of these. " He looks over at S and notices his tic-tac-toe background, three types of stamps, and typing. He says, "How do you do the different things? How do you do the different rows?" pointing at S's tic-tac-toe background.	

What seemed evident from experimenting via practicing and testing behaviors (whether methodical or not) was that children created products in the presence of those apps that allowed for image construction (e.g., *ABC Magnetic Board*, 2012; *Draw & Tell HD*, 2012) to a greater degree than they did when apps didn't provide for composing (e.g., *Pocket Pond* [2012] and *Fluidity* [2011]). Existing literature has sorted children's image creations into "basic forms" when such compositions were connected with experimenting moves (Escobedo, 1999), and into a "screen as landscape" orientation, in which students discovered, explored, and experimented with varying tools and action schemes (Labbo, 1996). When children linked their compositions with object construction and fantasy, Escobedo (1999) labeled the compositions as at the "pictorial stage" of drawing. Labbo (1996), on the other hand, described children's pictorial representations as indicating a "screen as canvas" stance as evidenced by their making "a work of art by using line, pattern, painting, color, clip-art icons, special screen effects, and drawings on the computer while considering the aesthetic and artistic qualities of their work" (p. 372). During these experiences, Labbo noted that children devoted "a great amount of effort and time to creating a carefully crafted pictorial composition" (p. 373). Similarly, the children in this study, engaged in such focused and purposeful image creation—an examination to which we now turn.

Experimenting Via Creating/Composing

A final property associated with playing to experiment with the open-ended apps students engaged with in this study is a mode in which students spent extended amounts of time creating or designing an image. To be sure, students' creations were interjected throughout children's experimenting actions. But many incidents indicated students' movement between and from experimenting via testing and practicing to a creation mode in which their central goals seemed related to the completion of some overall composition. Their completed pieces included non-representational compositions [akin to Hall's (2010) finding on children's symbols/patterns/abstract drawings], representational compositions [similar to Labbo's (1996) findings on children's object pictures and organized scenes], backdrops for facilitating game play [similar to Labbo's (1996) findings on screen as playground], and on rare occasions, creation of frames for brief sociodramatic play [similar to Labbo's (1996) findings on screen as stage, and Escobedo's (1999) findings on children's creation of graphics that evidenced symbolic play behaviors]. I next give examples of each of these types of creations, before discussing how my findings align with previous research.

Experimenting Via Creation of Non-Representational Compositions

After experimenting via testing/practice with tools and media, some students took actions to create non-representational compositions. These were compositions that often included patterns of objects, or piles of objects, and did not seem to indicate (or need) representational form. As students composed, they did not always ascribe any representational value to the patterns (orally), but upon later reflection (e.g., talking to a tablemate, me, or themselves about their work) named or described their creations. Attention to children's non-representational compositions can offer important indications of children's interests in their creation-related play. Earlier research has noted children's interests in drawing people and natural environmental features, and that the majority of their drawings contained such elements (Hall, 2010). However, Hall also noted an increase over time in the amount of children's drawings that included "symbols/patterns/abstracts" (p. 166). Even so, Hall disallowed digital compositions in her analysis because, "as these only featured clip art images they were discounted" (p.

204); rather, she inspected only compositions created with traditional tools. In this study, I include compositions that feature "clip art" objects, arguing that children's compositions which incorporate "clip art" type icons are important for understanding the breadth of children's choices, interests, and actions while in creation mode (with the particular tools and their affordances). Further, patterning can be easily facilitate with repeated use of clip-art images (such as "stamps" and "stickers").

One example of a child producing a non-representational composition occurred during Week Three when two good friends Marie and Vera engaged with the app *Pattern Blocks* (2012) for over seven and a half minutes, side-by-side. It was Marie's first time to interact with the app, and Vera's second time (having engaged with it in sampling play for one minute the previous week). Figures 7 and 8 include screen-shots of each girl's creations.

> Marie began making a patterned image and a few moments later Vera opened the program and began making a snowman (see Figure 7). While Vera chose to make a representational image of a snowman wearing a hat, Marie created a more abstract composition with careful patterning. After designing her image, Vera looked over at Marie's image and began to erase her own composition and start over.
>
> Once her screen was clear, Vera next imitated Marie's pattern of lining repeated double-hexagons, but altered the pattern slightly by lining up the hexagons from left to right and top to bottom. Marie had begun her pattern at pattern the bottom left and adding double hexagons in stacks and then filling in with triangles from top to bottom. After approximately 60 seconds, Marie sat back and looked at her pattern and said, "I'm making a pretty thing…" (See Figure 8). She paused for a moment looking at her image and then looked at Vera's and said, "I'm gonna make… a, a town!" Vera looked back at Marie's image and quietly replied, "I'm gonna make…a town," to which Marie giggled and says, "This is so funny!" Vera replied, "I'm doing the same as you." Marie retorted, "I'm not doing THAT one…After this one I'm going to do a different one." Both girls continued adding blocks to their designs.

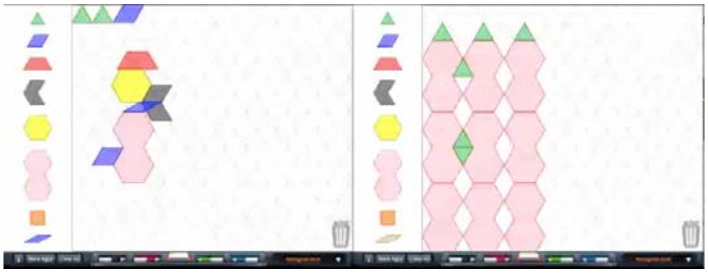


Figure 7. Vera's representational snowman (on left) and Marie's non-representational pattern design (on right)

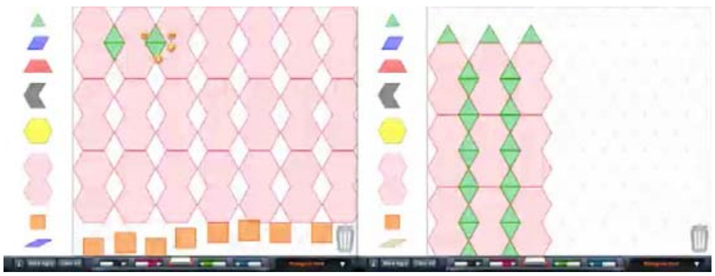


Figure 8. Vera's "Town" (on left) and Marie's "Pretty Thing" (on right)

Comparing the images in Figures 7 and Figure 8, both of Marie's designs, and the second of Vera's designs indicate non-representational compositions. Marie first named her design, "a pretty thing" before offering the title, "a town," thus transforming her composition from a seemingly abstract, non-representational patterned composition to a representational patterned composition. Vera initially created a representational design—a snowman—and then seemed to be influenced by her tablemate's composition, which led her to try a similarly patterned image. Unlike Cohen & Uhry's (2011) investigation of children's block compositions, Vera did not move from non-representational to representational forms, but rather the reverse. After creating a "snowman" she then erased it to create a non-representational composition, naming it "town" (and transforming it from "pattern" to representational image) only after her friend Marie had done so. In each of these examples, the girls experimented with both representational and non-representational compositions. The *Pattern Blocks* (2012) app elicited examples of abstract pattern designs from other students as well.

There were multiple examples of students' non-representational form creations via the *ABC Magnetic Board* (2012) app. The "clip art" feature of multiple sets of "magnets" offered may choices of image icons students could quickly rotate through, select, and slide up to create image compositions (e.g., letters, numbers, shapes, holiday images, nature images, etc.). Objects could also be resized via pinching or reverse-pinching (stretching)—an action with which some students experimented and practiced. Most incidents included players practicing sliding magnets repeatedly up onto the board, then switching magnet sets to continue adding objects. This resulted in compositions of magnet "piles" where images where crowded on the screen in no seeming order. However, there were also compositions that indicated various forms of patterning, either through grouping like objects (Figure 9, Row 1), making rows of like objects (Figure 9, Row 2), constructing simple color and/or object alternating patterns (Figure 9, Row 3), practicing letter ordering patterns (Figure 9, Row 4), or making numbering patterns (Figure 9, Row 5). These images (captured from multiple incidents with multiple students across several weeks of interactions) indicate that students engaged in purposeful patterning, a trend noted by Lambert (2005) as important and deserving of examination in equal measure to children's more representational compositions.

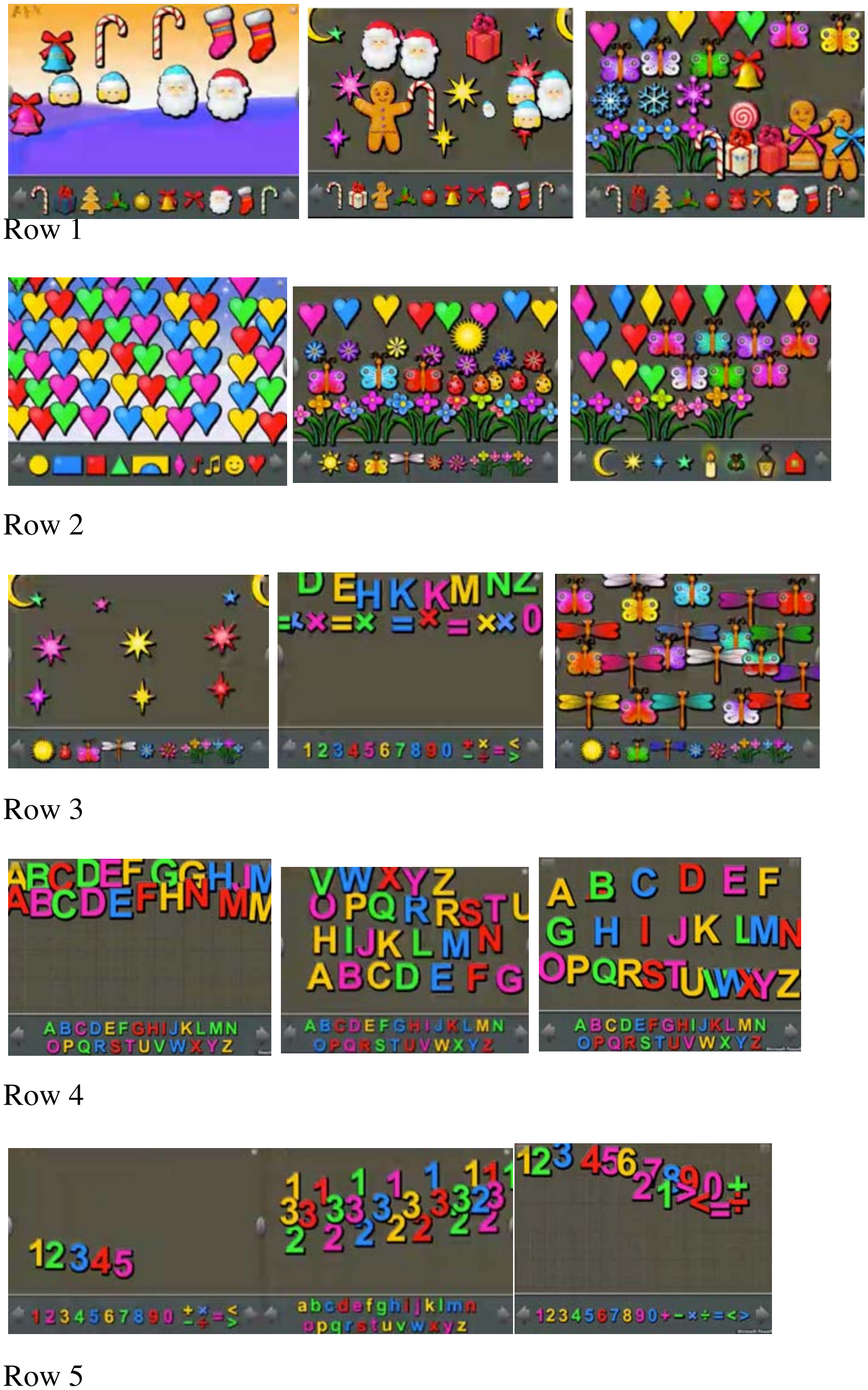


Figure 9. Screenshots of different students' pattern-based compositions

On some occasions, students combined actions and design strategies. There were several incidents in which Beth, for example, began making patterned and/or representational designs, but over the course of her creating she transitioned to creating image piles. Figure 10 represents a composition Beth created during Week Three. She began with a representational creation of a gingerbread family, then over the course of her time during this incident, found more and more magnets she chose to add, thus altering her early design into a non-representational image pile.

Figure 10. Progression of screenshots demonstrating Beth's movement from representational composition to image piles

In a different example that occurred during Week Five, Beth began with a patterned design but soon added so many objects that the design took on a more pile-like image. Even with so many items, however, Beth's pattern-like groupings of similar objects (e.g., row of diamonds, row of snowflakes, row of butterflies) remained evident. (See Figure 11 for three successive screen-capture images of Beth's composing.)

Figure 11. Progression of screenshots demonstrating Beth's movement from singular rows of patterns to piles of patterned rows

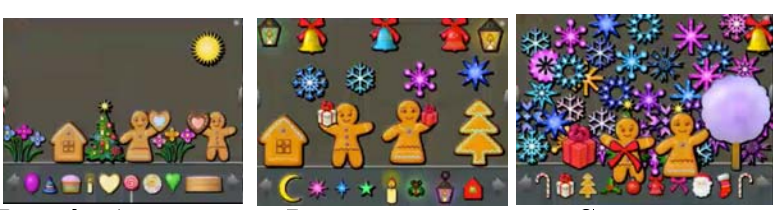
As Beth inspected the magnet sets, she seemed to find more and more of interest to her, adding them to the screen. As she did so, she composed groupings (a line of gingerbread characters, a line of lollipops) although some rows lacked space for many like objects (e.g., only six heart balloons, and only two candles fit on the top row of the third image in Figure 11). In each of these examples by Beth (Figure 10 and Figure 11), she began her creation by organizing objects in what appeared to be thoughtful compositional design, and then continued adding more and more objects, also altering her patterned design as she composed.

Both patterning and seemingly random piles of objects were common forms of non-representational compositions, and occurred often when an app offered an endless supply of icons that could be continuously added (e.g., *ABC Magnetic Board* [2012] and *Pattern Blocks* [2012]). Analysis of incidents across time and between students suggested that students moved between piling objects and patterning as they shifted between experimenting through practicing or creating. Such shifts were not always linear, but seemed to evolve as students interacted with their tablemates, discovered more choices, and became more adept (perhaps due to repeated practice) at placing objects. More will be discussed on additional contextual factors in a later section, but I first share more examples of students representational compositions.

Experimenting Via Creation of Representational Compositions

In contrast with non-representational compositions, some students carefully arranged colors, objects, and design to construct compositions that appeared to be more representational in form. The representational compositions included images akin to Labbo's (1996) "object pictures" (p. 373) and "organized scenes" (p. 375). The creations echoed snapshots of static images, and seemed to indicate purposeful design choices and careful object placement/adjustment to create a representational image. Examples of such representational images include an object (e.g., snowman), a family, a nature scene, or a party. Figure 12 includes six screen-shot examples of different students' representational works composed using the app *ABC Magnetic Board* (2012). These images seem to indicate students' purposeful design choices. On occasion, students even named their work, or explained what was happening in the picture. For example, in the last screenshot (Row 2, Photo C) of Figure 12, the creator (Beth) called for the attention of her tablemate and the researcher when she said repeatedly, "Look, they are having a party. Hey look, they are having a birthday party!"

Row 1: A B C



Row 2: A B C

Figure 12. Screenshots of different students' representational images created across the five weeks of the iPad station exploration

In each of the examples of representational compositions, students selected and placed objects with care as they created their desired design, removing items if the result did not satisfy them. In addition to composing with *ABC Magnetic Board* (2012) and *Pattern Blocks* (2012) are shared above (Figures 7 through 12), children produced representational compositions in *Scribble Press* (2012), *Doodle Buddy* (2011), and *Doodlecast* (2012). Figure 13 includes a sample of representational compositions (created by different students and selected from different incidents) from each of these apps.

Figure 13. Screenshots of representational formats composed in *Scribble Press* (2012), *Doodle Buddy* (2011), and *Doodlecast* (2012)

As with Hall (2010) students in the current study also engaged in drawing a variety of subjects, including people, animals, nature scenes, family scenes, vehicles, toys and play equipment, and even writing names (i.e., their own name or of other classmates).

Children’s experimenting that resulted in representational compositions allowed children to arrange, add, and delete objects, colors, or their own drawings as they saw fit, and as they were able, limited only by the available tools and/or their knowledge of how to use the tools. The composing mode was different from the testing and practicing mode in that students appeared to have design goals in mind, as evidenced by their thoughtful use of patterning and/or their representational compositions of objects or scenes.

Summarizing Experimenting with Media, Tools, Gesture, and Composition

As exemplified throughout the data incidents above, students engaged in experimenting through more sustained testing and practicing with media, tools, and gestures, and through creating compositions. Children’s testing moves included the sorting of media, deciphering of icons, and uncovering of tool capabilities—actions that seemed supported both by the students’ curiosity, as well as through social input (from the researcher or their tablemates), or even by serendipitous stumblings into new information. Practicing involved sustained, repetitious use of single or multiple media, tools, or gestural moves, and sometimes led to creation mode. Through the deciphering of icons and the related tool capabilities, students were able to gain experience, understanding, and manipulative skill through practicing and creating actions. Students’ practice with program tools and icons occurred in stylistically different ways, whether more or less methodical, and in varied orders and progressions. But in whatever stylistic mode their testing and practice occurred, these moves enabled students to experiment with manipulating tools and objects in order to gain mastery over tool use, facilitate game play, or create designs. When students created designs, they arranged, added, deleted objects, colors, or drawings in non-representational or representational forms, often resulting in completed images created for their own sake. Occasionally, these compositions served to facilitate game play.

Although there are some similarities with children's sampling approach, children's experimenting appeared to include more sustained testing and practice with media, tools, and gestures, as well as manipulative play for the sake of testing, practicing, and creating. When experimenting, children were engaged for longer periods of time, used more tools, and seemed to evidence more focused attention. These actions occurred during incidents that lasted for 2 minutes or longer, so that students seemed not to be sampling the program, but more engaged in experimenting through testing, practicing, and composing with available tools and gestures.

Incident review revealed that experimenting play occurred throughout the study—not only in the first weeks, or in students' early encounters with an app. When children encountered untried tools even in a familiar program, they sometimes stopped and tested the newly discovered feature. Examination of incidents across the study revealed that students engaged in sorting many different types of media that were afforded by each program. For example, some programs had many media tools and related icons (e.g. *Draw & Tell,* 2012; and *Doodle Buddy*, 2011) while others had few (e.g., *Fluidity*, 2011; and *ABC Magnetic Board*, 2012). Through testing and practicing, the students were able to observe program responses to their actions and make connections between icons and their functions (e.g., for adding color, selecting and moving magnets, clearing the screen). Students' sorting, deciphering, and uncovering were linked with their own curiosity, social input (from the researcher or their tablemate), and sometimes even by seemingly serendipitous stumblings into new information.

Engaging in Pretense: Stepping into "As If" Situations

In addition to sampling and experimenting, students also engaged in pretense play. Engaging in pretense was observed in 5% (20 incidents) of the total 374 incidents. Properties of engaging in pretense included students' creation of a play frame that was marked by imaginary situations, and sometimes characters and dialogue. There were incidents in which students imposed a pretense element on their designs (e.g., Pointing to a completed design and stating, "Look, it's a party in here," or pointing to a drawing and saying, "Ooh, I made a snowstorm, look at my snowstorm."). However, these incidents were not coded as engaging in pretense, but rather as a form of labeling their creations through experimenting play because no further indications of "as if" actions or behavior were evident. Instead, in the current data set, I chose to categorize incidents as including engagement in pretense as those in which students imposed play frames for dramatic play on their app interactions. This occurred with three types of apps: limited construction/simple gestural exploration apps, apps with character-based show recording features, and, on two occasions, a design-creation app. These displays of engagement in pretense were similar to Labbo's (1996) "screen as stage" stance.

Engaging in Pretense with Simple Gestural Exploration Apps

In a few instances (7 of the 20 total pretense play incidents), students created play frames while engaged with limited construction/simple gestural exploration apps. These were apps with limited options for adding/manipulating objects or altering the app output, and mainly offered opportunity for gestural exploration. In these seven incidents, amidst adding, arranging, or manipulating objects/gestures during experimenting play, students briefly created frames for dramatic play. The two apps in which this action was observed were *Pocket Pond* (2012) and *Fluidity* (2011).

The *Pocket Pond* (2012) app includes a full-screen image of a bird's-eye view of a pond, replete with rocks, rippling water, mud, and swimming fish. A touch to the screen agitates the "water" around the tapped location and engages the speakers to emit a rippling sound. When fish occasionally swim across the screen, a tap on or near them will send them swimming off-screen. A small menu, engaged with a tiny plus-sign icon, reveals additional items that can be added to the "pond" (fish, dragonflies, fish food). The other gestural exploration app, *Fluidity* (2011), offered even fewer construction options, as its main provision was a screen filled with colorful liquid and bubbles that could be agitated and swirled around. The liquid changes colors every few seconds, and lights streak through it as it is touched and manipulated. The viscosity, speed, and colors can be manipulated via a small palette with text and sliding scales. Examples follow of the brief dramatic play incidents with both *Pocket Pond* (2012) and *Fluidity* (2011).

In a Week Two iPad station visit, two good friends, Juan and Wayne opened and interacted with *Pocket Pond* (2012) (simultaneously, and for the same amount of time) in three separate incidents. The first incident lasted 1 minute, the second 10 seconds, and the third/final incident lasted for 5 minutes. These three examples are followed by a fourth example that occurred during Week Three as Juan engaged in the same app with a different friend, Will.

> During the first encounter, Juan began by tapping around the screen, agitating the water until Wayne grabbed his hand saying, "No, no, no…nnno, you gotta wait for the fishies." Both waited and then tapped at their respective fish. Juan confirmed, "Are you supposed to scare the fishies?" Wayne didn't respond but instead tapped at a fish swimming across his screen and replied, "I got a fish." They continued this pattern of waiting and then tapping at fish swimming across the screen for 60 seconds.
>
> When they revisited the game the second time, they exhibited a searching mode, and closed *Pocket Pond* after 10 seconds.

The third time, both boys resumed their game of tapping at the water using a variety of gestural moves so as to "scare the fishies." Both began jabbing at the screen to agitate the water until Wayne implored, "No more!" as both boys pulled their hands away from their screens. Juan stared at the screen, watching for fish and exclaiming, "I love fishee…FISHIE!!" As he screamed "fishie" he then jabbed his finger toward a fish as Wayne reached over to help. They both screamed and laughed, with Wayne noting, "Oooooh, I scared that fish!" They each then pulled their hands away from the screen and waited for more fish to come. The boys repeated this pattern of waiting, watching for fish, and jabbing at them while screaming. As the fish swam off-screen, the boys commented on the situation, including statements such as, "That was a BIG fishie," and "Awww, where's MY fishie," and "I found four fishies…to scare." When a relatively big fish swam across the screen, Wayne tapped rapidly at it, hollering, "YO, yo, yo, yo…OH those were a BIG fishie [giggles]." Juan looked over and said, "You found a shark…to scare it away!" In addition to statements about their observations, they also verbalized strategies for getting fish to come, "Don't do it yet! Don't do it…you gotta wait, okay?" At one point, while glancing over at Juan's screen, Wayne noticed a small white plus sign in the top left corner. He tapped it and a box of icons slid onto the left-hand side of the screen. Juan tapped a lily pad icon, moved it over, and it dropped onto the screen, after which Wayne exclaimed, "I wanna do that one!" Both boys continued tapping the "water" and Juan began sliding the lily pad around his screen. Wayne turned to his own screen and, after a short search, found the icon for the palette of choices and tapped the images that dropped the selected item (lily pads, fish, food, dragonflies) into the pond. Both boys added lily pads to their screens until Juan tapped a dragonfly onto his screen. After this move, Wayne leaned over and said, "How did you do that?" They both laughed and tapped at the dragonflies, and then Juan added more fish. They continued their game for 5 minutes, trying multiple moves to "scare fish" and adding objects for their fish.

During Week Three, as Juan played the same game with his friend Will, he began to add items to the fish pond and told Will what to push to add them to his own screen. "Put them!!!" he implored Will. Will added three lily pads to his own screen and then replied, "Why you need that?" Juan replied, "I just want to make a picture…for fishies! Wheee!" He added more items (lily pads, fish, dragonflies) as Will began to add more items and then pointed to his screen and said, "I put that for fishy." They continued adding items with Juan encouraging Will to add more, and Juan looked at his creation and said, "My fishies are just swimming around the pond!"

In both the Week Two and 3 examples, students engaged with the *Pocket Pond* (2012) app and with each other in a play frame centering on an "as if" situation in which they took actions (gesturing against the screen) and verbalized their intent to "scare the fish" (which were not really fish, but pixilated and colored shapes designed to look like fish). Furthermore, they added items to their "fish pond" in order to "make a picture…for fishies"—a tactic that also contributed to their play frame of scaring fish. The boys used their interactions with the "water" and the "fish" to create a pretense scenario in which they pretended to wait for fish, and then to scare them away. They even created a brief narrative about big fish representing sharks, and how sharks might be used to "scare the fishies." In the Week Three example, Juan introduced this play frame to his friend Will and the two friends continued to engage in the pretend scenario of waiting for fish and scaring them.

In addition to students' multiple gestures to "scare fish" in *Pocket Pond* (2012), other students verbalized different pretend scenario. For example, during Week Four, Simone, after quietly experimenting with multiple gestures and moves, started swirling her finger around the screen rapidly, agitating the water into a swirling motion. As she did this she exclaimed, "There's a tornado! There's a fast tornado!" She then began tapping with open palms rapidly at the water, watching it and looking over at her tablemate's screen (who was also engaged in the same actions), then back to her own screen. She then stopped her motions and watched the water, stating, "Now it's gone." She tried a few more gestures before closing the program.

In an example with the *Fluidity* (2011) app, Simone used multiple gestural moves as she pretended to do magic with the color changing bubbles and "liquid" during Week Three. This was a favorite app of Simone's (indicated by her in a brief interview at the conclusion of the study) and she named it, "the magic one." Two incident examples are included here:

> Week Three: Simone tapped on the program icon and as it opened whispered, "Wow!" and then made various moves of her finger across the screen watching the colors change and bubble swirl. As she swirled her finger around and the colors changed she exclaimed, "I'm powerful! ….Whoooo!!....I'm having so fun…." She slowly drew her finger down the screen and then rapidly swirled it in smaller and smaller circles. She then altered her hand position by opening her palms to cover and swirl around the whole screen, hooting, "Ah, ah, ahh, whooo, whooo, who-o-o-o-o!....MINE!" She paused briefly to say hello to a teacher who entered the room, then turned back to her screen and slowly moved her index finger back and forth, singing, "Daaa, daaa, daaaaa….I make everything powerful…wis everything."

> Week Four: Simone again opened the program and quietly experimented with multiple gestures—with her finger and with the stylus—before engaging other apps and then returning to *Fluidity*. Upon her return, she began singing "Up on the Housetop," as she swirled her finger through the "liquid". She then interrupted her song to state, "I'm magic!" She waited until her tablemate opened the same program too, and then re-stated, "I'm magic," as she swirled her finger through the liquid. This was a continuation of a theme she had started in Week Three. She swirled her finger around the screen, agitating the bubbly liquid and lights saying, "Ehhhhhh, ehhhhmmm. I'm powerful!!! Whoo-hooooo!!!" As she moved her finger more rapidly through the liquid she made noises, "Oooh, oooh, ooooh!"

For this student, the moves she made through the "liquid"—whether slowly, or rapidly, with one finger or both hands—were her construction efforts to become 'powerful' and enter into her play frame of magic. Although her "as if" situation did not include other players, her interactions with the images on the screen—changing colors, swirling bubbles—enabled her to engage in her pretend play where she imagined her gestures as evoking and creating magic. As the images changed in connection with her gestures, she responded that she was powerful—her magic fingers and movements were working, and powerfully!

In another brief example, two students created a different "as if" scenario using the same *Fluidity* (2011) app. Glenn and Tony each opened the app on their own tablets and participated as follows.

> Glenn and Tony made shooting noises while swiping their fingers across the screen in *Fluidity*. Tony said, "The battle…the battle. The battle of Joggle City!" Both boys then continued to make shooting and explosion sound effects as they swiped and swirled their fingers through the "liquid." When Glenn copied Tony's noises, Tony told him to stop, so Glenn paused for a moment and then slightly altered his sound effects, saying, "Spiderman! Pshhhhhhhww, pshww…pshh, pshh." Tony paused and looked at him and then started humming. Both boys continued trying multiple gestural moves, Tony humming and Glenn interacting with the screen silently. The two eventually resumed making sound effects and noises, with Glenn murmuring something about "ice" and "strong" while Tony made more shooting and explosion noises. Glenn then tired of the app, saying, "I don't want do this…hey, I don't want to do this!" Tony told him, "Then press this," pointing to the home button, and Glenn switched to play *Pocket Pond*.

Tony suggested verbally that he was engaged in an "as if" situation that centered around a battle, particularly, one situated in Joggle City. Both boys used gestures and sound effects to evoke the fighting in the battle. After a few moments, however, Tony indicated that Glenn was no longer to be part of his battle scenario by telling him to stop (presumably to stop imitating his sound effects). Subsequently, Glenn quickly verbalized a different "as if" scenario that could also included fighting—Spiderman! After a short pause in battle sound effects (in Joggle City and with Spiderman) the two boys each resumed their battle sound effects and continued with their parallel (but different imagined scenarios) battle moves.

In both *Fluidity* (2011) examples (Simone's and that of Glenn and Tony), the students' verbalizations indicated an imaginary situation, characters (themselves or superhero), and brief dialogue directed both toward the screen or even sideways to a tablemate. In both situations the pretense play lasted only moments as it was either ended by the instigator (Simone, and eventually Glenn) or refused by the tablemate (Tony's negation of Glenn's joining in his "battle of Joggle City," and Tony's ignoring of Glenn's new Spiderman play frame).

Both *Pocket Pond* (2012) and *Fluidity* (2011) offered limited construction options for adding objects and designing images. Even so, after some manipulative experimenting play, a few students also briefly engaged in pretense play, similar to Labbo's (1996) finding of children using the "screen as stage" to enact imaginary scenarios. In seven incidents across the study, there were students who used icons and/or gestures to create play frames for themselves and their partners that were linked to "as if" scenarios and pretense play (e.g., scaring fishies, doing powerful magic, engaging in a battle, becoming a superhero). While these examples demonstrate very brief forays into pretense-related play frames, there were three additional programs (*Sock Puppets*, 2012; *Toontastic,* 2012; and *Draw & Tell HD,* 2012) that enabled children to engage together in longer and more interactional "as if" play frames. It is to these examples that we now turn.

Engaging with Pretense Using Character-Based Show Recording Options

In 11 of the 20 engaging in pretense incidents, there were examples of pretense play in which students engaged in longer and more interactional dramatic play. In these instances, students' language took a more narrative turn (Wolf & Grollman, 1982) as might typically be observed in a classroom puppet area or dramatic play center. This type of pretense play, assuming both an "as if" scenario and demonstrating some observable narrative structure, was observed to occur with the character-based show recording options in three apps: *Sock Puppets* (2012), *Toontastic* (2012), and *Draw & Tell HD* (2012). Both *Sock Puppets* (2012) and *Toontastic* (2012) included options for selecting characters/backgrounds, and creating/recording their characters' movement and dialogue. The recordings could then be saved and played back for the creators. Technical difficulties (my computer and screen capture software froze when students engaged this app) resulted in the removal of these two apps from the rotation after Week One, but several children tried these programs before they were removed. Furthermore, one app that included a character selection and voice/movement recording function, *Draw & Tell HD*, (2012) remained in the rotation. While only a handful of students discovered this feature of *Draw & Tell HD* (2012), those incidents provide additional evidence for how students created play frames and engaged in pretense while using this and the other two "show recording" apps.

Using the *Sock Puppets* (2012) app during Week One, Maya and Wayne were sharing the same iPad as the following interaction occurred:

> Upon the suggestion of onlookers (Cherry and Tony) who implored, "Do puppets," and "Yeah, do puppets…you get to MAKE puppets," Maya and Wayne both tapped on the icon title. After watching an existing puppet show, the pair agreed that they wanted to make their own recording. With assistance from me on how to begin a new show, the pair selected a background (space), and puppets (superkid and ghost). I explained briefly how to touch one's character and talk, then remove one's finger to let the other person have a turn. The show recording continued:
>
> Holly: (Pushes recording button and points to Maya to begin)
>
> Onlooker: Talk…TALK!
>
> Maya: (Looking at ghost and tapping it)
>
> Holly: (in a high-pitched voice) Hi!
>
> Maya: Ummm…
>
> Wayne: I wanna do it!
>
> Onlooker: Shhhh!
>
> Maya: Hmmm
>
> Holly: Okay, Wayne, now you touch yours and make yours talk.
>
> Onlooker: Say something!

Wayne: Um, I wanna…gonna pinch you.

Holly: Okay, now you talk, Maya.

Maya: (Quietly) Please don't pinch me. I'm a good ghost.

Holly: Okay, now you talk, Wayne.

Wayne: (In a gravelly voice) Well then I'm not gonna play with you because you're aaaaahhhh…you're scary. (Moves Superkid away from ghost.)

Maya: You don't say that. I'm going to the ghost (inaudible) and the jail. I don't want my brother's and sisters to go there.

Wayne: (In a growling voice) Heyyyy, no gonna pick up. Pshhhwwww! Pckkwww! (Moving Superkid toward the ghost and back away)

Maya: (Tapping her ghost as she talks) What? I'm a friendly ghost. And that makes me a happy ghost! (Louder) I'm friendly, I can play with you!

Wayne: (Growling loudly) Heyyy! You're not gonna, Pops! Hey, you're mean! Because, pshhwwww!!! (Slides Superkid over to ghost and back)

Maya: (Quietly but firmly while moving Ghost toward Superkid) Well, I'm gonna do everything if you, if you be mean, I won't give you your toys.

Wayne: Yep! I GOT your toys!

Maya: Yes. (The screen pops-up are red box indicating the recording time is up.)

After the recording stopped the two watched the video play back, with Wayne grabbing the speaker and putting it up to his ear to listen more closely to his and Maya's voices. Both smiled and Wayne laughed as they watched the screen and listened to the playback of their voices.

In this example of two children's first steps with digital puppetry, Maya and Wayne spent the first moments acclimating themselves to the program choices and to how to take turns tapping their 'puppet' and creating dialogue. After a few seconds of prompting from me, they settled into their play frame as Wayne enacted a Superkid character (replete with sound effects and rapid gestural moves of his character toward Ghost) interested in fighting with the ghost character. Maya enacted a "friendly ghost" character trying to get the Superkid character to play with Ghost. Maya resisted Wayne's fighting play frame while Wayne resisted Maya's playing-together play frame. Even so, each listened to the other's conversational turns and even included some of the other character's language in their responses. It took a few moments for Maya and Wayne to take up pretense play because they had to navigate this new space of a digital puppet show. However, once they acquired the necessary technical and manipulative skill, both quickly settled into verbal sociodramatic play, accompanied by some movement of characters on screen. Although they shared the same literal play frame—in a space-setting background on a shared iPad—their narrative indicated their differing views on how to share the same play frame theme (fighting versus playing together).

In a second example with the same app, two students were able to more quickly move into a shared play frame and record a short episode of pretense-play. On the same day of the previously described incident, immediately after Wayne and Maya left the table, two of the onlookers—Tony and Cherry—grabbed their chairs and tapped on the *Sock Puppets* (2012) icon.

> They tried to tap on the existing Ghost and Superkid recording, but when it didn't immediately open Cherry said, "We don't want to do that," and Tony agreed, adding, "Yeah, why is it not doing it?" Cherry responded, "We want to do our own." I verbalized which icon would open the program menu options, after which they quickly navigated through the character selection (zebra and bat) background selection (treehouse), pausing briefly only to look at all the options before choosing. They then pressed the record button and began their "show" with Cherry as Zebra and Tony as Bat. The dialogue continued as follows:
>
> <u>Holly</u>: You're going to press the record button and it won't go until you press record. And you have to take turns.
>
> <u>Cherry</u>: (Pressing the record button and speaking in an altered voice) Hello, hi. What are you, what are YOU doing? Why are you just flapping your wings? Whaaaat??

Tony: (Higher voice) I just wanna play and I'm just doing this because I want to. That's how I get energy!

Cherry: (Sliding Zebra over) Well what? I don't want to. Why do you have to DO anything? Huuuuh??? What you say? Ah, smack yourself! (Moves Zebra away)

Tony: I just scratched you on the neck. Scratch! (Slides Bat over to Zebra and quickly back.) You're welcome.

Cherry: I'm gonna hit you! (Slides Zebra over)

Tony: I'm gonna kick this ball at you, KICK! (Slides Bat toward Zebra and back again.)

Cherry: Bye! (Moves Zebra away to the edge of the screen.)

Tony: Kick ya ball, kiiick, kick, kick, kick, kiiick. (Slides finger over a ball in the background repeatedly which doesn't move. He then slides Bat over almost off screen so only the tip of the wing is visible, and when trying to slide it back inadvertently catches Zebra and slides it over.)

Cherry: (In growling voice) Hey, you give me mine back…ooooh! WHAT ARE YOU DOING? (She slides Zebra over.)

Tony: (Tries to slide Bat over but the character has disappeared off screen. He nods his head looking at it and the looks at Zebra and whispers) 'Kay…Talk!

Cherry: (Low voice) Whaaaaat? I don't know what you're doing..aaaahhh?

Tony: I'm just (tries to catch Bat's wing but can't move it) I'm just doing stuff at my desk.

Cherry: Uuhhh, bye-bye. D'uh! (Taps her Zebra, sits back in her chair, and looks up at Holly, who saves the recording. They both watch and laugh at the playback. They then decide jointly to entitle their show "Bat versus Zebra.")

In this incident, the students spent less time acclimating themselves to how the program worked, and how to take turns tapping, moving, and speaking for their characters. As soon as the recording button was pressed, both children immediately began their shared play frame of inquiry ("what are you doing") and fighting, interrupted only briefly by a program issue when Tony's character slipped off screen. His whispering for

Cherry to keep going, "'-kay…Talk!" indicated his desire to maintain the show/play-frame even amidst his technical difficulties. Cherry tried to come up with a way to extend the frame but when she couldn't think of anything else to say she responded, "Uuuuhh, bye-bye." After watching the playback and giving it a title, the two moved on to a different app for a few minutes, then returned to *Sock Puppets* (2012), selected a different background and different characters, and created a second "show" with similar inquiries and fighting themes.

In all of these *Sock Puppets* (2012) examples, the students' pretense play was elicited by the program itself—one that was centered wholly on setting up a pretend, 'as-if' scenario via the players' selection of backgrounds, characters, props, and the recording feature that structured a starting and ending time for 'as-if' dialogue and movement to occur. Unlike classroom dramatic play centers, this program allowed participants to capture their dialogue and character movement for later playback and review. The students did smile and laugh when they watched the playback, but as long as this app was on the iPads, no students asked to view their 'puppet shows' again after the initial review. It seems the interest centered around entering into a pretend scenario, enacting characters' actions and speech, then watching the result once before creating a new show or moving on to a different game. This pattern held constant for all students engaging with *Sock Puppets* (2012), in that there was an initial acclimation to the program (either by actions or by watching others) before stepping into a play frame and enacting characters' voices and movements. Furthermore, once the recording had been viewed, students did not ask to watch their creations again. A few students later inquired about playing the app again, but due to technical difficulties it was no longer available, perhaps affecting the invitation and results for pretense play across the study. It is possible that students might have asked to watch their creations in later weeks if the app had remained on the tablets. The existing data suggest these students' experiences in pretense-related play were focused on in-the-moment pretense rather than focusing on creating narratives to be preserved and revisited.

Concerning the other "show-recording" app, *Toontastic* (2012), only three students chose to open the app. Of these three, one child engaging briefly in sampling play, and the other two engaging together briefly in pretense play. The pair of students—Maya and Wayne—who engaged in brief pretense play with the app on a single, shared iPad during Week One resulted in the following pretense-play encounter:

> After brief assistance from me on how to create a background, both students slid their fingers across the screen, adding bright green paint on the screen. I guided them on how to add characters and noted, "If you press the green button, you can move your characters around and make them talk." Wayne pressed the green button followed by Maya, and both tapped at the screen as it flashed the text, "3—2—1 action." Both students stared at the screen for a moment as an onlooker said, "Move them!" I responded, "Now you can move them and say words." The dialogue continued:
>
> Wayne: (Tapping a pirate and then tapping other pirates) Hello!
>
> Maya: Hello! (Tapping pirates around the screen)
>
> Wayne: (Tapping on a monkey) Hellooo. I'm a little bouncer!
>
> Maya: (Tapping at different characters)
>
> Onlooker (Tony): How are they going to say words?
>
> Onlooker 2 (Cherry): THEY'RE saying it.
>
> Wayne: (Sliding a pirate and speaking in a gravelly voice) Heeeyy. Fighting pirate! Mean!!!
>
> Holly: Okay now take your finger off and let her try.
>
> Maya: (Sliding a pirate up) Nnnnnever.
>
> Wayne: (Sliding his pirate) Yyyyeahh, sssss, pshwwww!

Maya: (Tapping at a pirate and trying to slide it around)

Wayne: (Looking at the screen and then tapping and sliding a pirate) Mmm—mmm—mm—mmmm.

Maya: (Tapping at pirates and then taps at the shark and slides it up) Shark.

Onlooker 2 (Cherry): Can I try after them? They're taking a long time.

Maya: (Sliding the shark around and watching it closely)

Onlooker (Tony): Can I try after them?

Wayne: Nnoo, I wanna do another game. (He pushes the home button)

Maya: I wanna choose one.

I paused to demonstrate how they could watch the playback. The two watched it, smiling and tapping at the characters as they moved, but quickly indicated their desire to try a new game.

Much like the *Sock Puppets* (2012) examples, the players sorted out how to move the characters via tapping and sliding before they entered a play frame. Wayne's dialogue indicated a fighting pirate play frame, and Maya responded briefly with, "Nnnnever!" However, the pretense wasn't held for long as both students were experimenting with gestures and movements of the characters, and onlookers were rushing them to hurry up. Later in the session, Wayne tried to re-open the app twice, but Maya quickly tapped the home button stating, "We already did that one." They did not again engage with the app nor did they ask to play it again on later dates.

The final app that included a few forays into pretense was *Draw & Tell HD* (2012). This was an app often used by students to draw, or to color in line-drawings, but which also included a background and character selection feature, along with the capability to record character movements and dialogue. Only four participants engaged with this feature of the app: Tony, Simone, Juan, and Will. The latter two students, Juan and Will, only engaged the feature for a few seconds (Juan tapped the recording icon briefly and observed the response without recording, while Will recorded mere seconds of himself saying, "Bye-bye, bye-bye, bye-bye, bye-bye!") Only Tony and Simone engaged for longer periods of time in pretense with this app, as follows below.

This example of Simone's pretense-related play with *Draw & Tell HD* (2012) occurred during Week Three.

> Simone asked, "Where's the puppet show?" I replied that the puppet show wasn't working but she could make a puppet show with *Draw & Tell HD*. She tapped open the program and with a little assistance from me she chose her background, and tapped the icon that allowed her to select her desired characters. After selecting 10 characters (three cats, a gnome, a monster, a fish, a bear, a sheep, a squirrel, and a mountain lion), I asked if she wanted to record her voice and she nodded and asked, "How?" I pointed to the microphone icon and told her to press that icon and move the stickers. As the voice-over counted down, "3—2—1, GO!" Simone looked at the screen and waited. I reached over and moved one cat and said, "Hi!" She then took up this pattern of moving characters and creating her own dialogue, touching the characters one at a time and jiggling them slightly from left to right as she voiced dialogue.
>
> <u>Simone:</u> (In a high voice) Hi, Hi, my name's cat. (jiggles another cat) Hi, my name's Cat. (In a lower voice) Hi, my name's Monster. (In a middle-pitched voice) Hi, my name's Elf. (In a high voice) Hi, my name's Kitty. (In a normal speaking voice) Hi, my name's Fish. Hi, my name's Squirrel. (In a slightly deeper voice) Hi, my name is Mouse. (In a normal speaking voice) Hi, my name's Lamb. Hi, my name's Monkey Ice Cream.
>
> Simone then pulled her hand back, looked up at me, and I told her which icon to press in order to stop the recording. I then told her to press play if she wanted to watch it play back and she pointed to the triangular play icon and queried, "This?" I confirmed, she tapped it and watched her video play back. When it finished playing she smiled and giggled. Her tablemate (not participating in the study) asked for some assistance and Simone looked over and then back to her iPad and said in a low voice, "Hi, my name's Monster." She leaned in and asked, "I wanna figure out some more," as she started tapping at more characters. However, just at this moment I had tapped the play button again so she could hear better and it replayed the show a second time with a louder volume. She watched and laughed again at the final line "My name is Monkey Ice Cream" (The character was a picture of a mountain lion holding an ice cream cone). When the replay finished, she said she wanted to write, "I want to write on it (swiping her finger up and down on the screen)—how do you write on it?" I indicated the three icons that

> would allow "writing" and she tapped on a rainbow crayon and swiped her finger across the screen, remarking, "Rainbow!!" She then became engrossed in adding colors to her screen, systematically adding swirls of each color from left to right.

Simone's engagement in pretense seemed only to last for those few seconds when she moved and voiced the characters on the screen, in a play frame that consisted mainly of introducing all the animal characters in their particular voices. She might have added or extended the play frame, as indicated by her words, "I wanna figure out some more," but unfortunately, I interrupted her by playing back the recording again. Thus, the factors connected with this short engagement in pretense included the program itself and its time-bounded recording capability, her interests in the available characters, my prompt of moving a character and beginning, "Hi," and my interruption of her interest to "figure out some more." Although Simone engaged in dramatic play for much longer periods of time almost every day during classroom center time (in other areas away from the iPad station), her pretense play was more limited at the iPad station, including this incident and a few others in which she pretended to "do magic" in the *Fluidity* (2011) app and stir up a tornado in the *Pocket Pond* (2012) app.

One other student—Tony—engaged in pretense play with *Draw & Tell HD* (2012) and happened also to be the person who most often engaged in recording little videos. He recorded "shows" with *Sock Puppet* (2012), *Draw & Tell HD* (2012), and recorded drawings with *Doodlecast* (2012). Throughout the study he looked for and verbalized interest in engaging with apps through which he could "make a show". Tony's first interaction with the recording feature of *Draw & Tell HD* (2012) occurred during Week Three.

> After asking about the "puppet show" app and finding out it was no longer available, he said, "But. . . but, but is there an other app that you can, that, that makes a show?" I responded, "Yes, there is, I can show you how to make a show if you're interested?" Tony replied, "Yeah, I wanna make a show." I then walked

him through the set-up of *Draw & Tell, HD*, including selecting a background (he chose a colorful circles background and then changed his mind and switched to rainbow stripes), selecting characters (he chose a gnome, a mountain lion, a mouse, a bird, a fish, a smaller bird, and three bees) and tapping the recording icon. As he tapped the recording icon I said, "And then you can move the stickers while you talk, 3, 2, 1, go!" He paused for a moment with his finger hovering over the mouse character. I pointed toward it and moved my finger and he tapped and moved the mouse over beside one of the bees. I said, in a low voice, "Hey…" He then continued the dialogue as follows:

Tony: Hey, what's up, dude? (Leaves mouse by a bee then slides bird on top of the mouse) Whatchu doin'? (Moves second bee on top of mouse) I'm doing nothing. (Moves gnome near pile and then slides it all around quickly before leaving it in the pile) Dahhh, doooey. (Slides another bee back and forth rapidly and then puts it in the pile) Uhh-uhh-uhh-uh. (Takes finger off bee and looks up) Done.

All the characters ended up in the pile except one of the birds. I then indicated which icon would enable him to watch the video playback. He tapped it and leaned in closely to watch. As it ended he looked up at me, smiling. He said he wanted to do another and would erase everything (though his selection of the eraser and swiping of his finger did not erase the characters). I indicated how he could pull the characters off to erase, or hit the backwards arrow button to start a new creation, or find his previously created work. He started a new image and expressed his interest in recording his drawing. However, this program didn't record drawings so after creating a drawn image he asked, "How do you make it do your painting?" I indicated that the program didn't record drawings but he wanted to check for himself and tried pressing the record icon. This experiment didn't work, and as he was trying to record, he heard his tablemate, Glenn, getting excited about his *Pocket Pond* game. So Tony switched to *Pocket Pond,* and interacted with it for the rest of his time at the iPad station.

Similar to his play frames earlier with *Sock Puppets*, (2012) Tony's play frame in this incident seemed to begin with social engagement ("whatcha doin? I'm doing nothing") and morphed into a fighting theme, mainly indicated through his rapid movements of the characters and his sound effects. Once he watched his video, he did not wish to engage in an additional dialogue-driven 'show' but wanted to record his drawing. Perhaps because this type of recording feature wasn't available, (and, perhaps, because he heard his tablemate making noises alongside him) he became interested in his tablemate's game and switched to "catching fish" in the *Pocket Pond* (2012) app.

Tony used this app to create a "show" a second time during Week Four (several weeks later, due to holidays and school break).

> Tony again asked, "Do you have an other app, where you make a show? Do you have an other making-show app?" I said, "Yes, I have two apps that make a show. One records your drawing while you draw…" He interrupted and said, "Okay, where's that, where's that one?" I pointed to the *Doodlecast* icon and said, "That's this one." He pointed to it and asked, "And the other one?" I responded, "And the other one is this one (pointing to *Draw & Tell HD* icon)—that's where you pull up little stickers and you can make them talk, you can have them talk to each other." Tony looked at his screen and said, "I wanna do this one (tapped on the *Draw & Tell HD* icon)…where are the stickers?" As this was several weeks since his previous *Draw & Tell HD* experience (due to the winter holidays) I again walked him through the ways he could select a background and characters. While looking through the backgrounds he asked, "Do you have a park one in here?" As a "park one" was not available, he selected a red and black checkerboard pattern, saying, "Oooh, I wanna pick this, this dance floor one." He selected 13 characters (mountain lion, gnome, mouse, cat, monster, squirrel, four redbirds, another mouse, two lightening bugs) and then asked, "Okay, how am I going to make them talk?" I reminded him how to tap the microphone icon and then move the stickers while he talked. The dialogue was as follows:
>
> <u>Tony</u>: (Tapping the mouse and sliding him to the right) Hey, whatcha doin' little thungg? (Taps on the monster and slides him beside the mouse) I'll kick your butt, yahh-uhh uhh uhh (shaking monster around, then taps one of the birds and slides him around and over beside the mouse) Hey, what ya doin? Yahh, uh uh uh...(moves another character) Hey what ya doin? Ya uh uh. (Slides mountain lion around and near the animal pile) Ya-uhuhuh yaaa. (Slides a lightening bug over to the pile) Yah, uh-uh! (Slides another bird over) Yeah! (Slides gnome) Yeah! (Slides lightening bug) Yeah, uh-uh. (Slides bird) Yeah! (Slides squirrel) Yeah uhh! (Continues tapping characters one at a time and sliding them into a pile in the bottom right corner of the screen, saying 'yeah, uhhh' as he jiggles and then drops each character. He slides the final ones into the corner pile) Yeah, yeah, yeah, yeah, yeaaaah! Done. (Lifts stylus and puts his hand on his chin.)
>
> I then reminded him how to stop the recording and how to play it back. He played it back and watched the entire show, then said, "Okay, now I want to paint, now I want to paint." Remembering that he had earlier wanted to record his

painting, I asked if he wanted to record his painting or just wanted to draw. He indicated he wanted to record his painting, so I guided him to *Doodlecast* in which he spent the next fifteen minutes recording his drawings and watching the playback.

As with his first *Draw & Tell HD* (2012) "show," Tony's second pretense play incident included a social approach ("whatcha doin' little thunng?") and moved into a fighting theme, replete with rapid movements and sound effects. As with his earlier experiences, he watched the playback once and then moved on to other apps. He did, however, during Week Five, seem to stumble upon this recording again as he experimented with new icons in *Draw & Tell HD* (2012). I mentioned, "I think you made that video," and he responded, "I DID!" He watched the video again, called another friend to come over and look, then hit the back arrow as it finished, scanned the thumbnails of other completed images, and then closed the program and selected a different app. In this instance he did not choose to create a show with characters and dialogue, but only reviewed his earlier created show. This was the single instance throughout the entire study that a student re-watched a show they had made previously in *any* of the apps with a recording option.

Engaging in pretense, as associated with each of the "show creation" incidents, included students' actions to acclimate themselves toward background selection, character selection and movement, recording tools, and voicing dialogue. For some students, this was a rather quick process, while others seemed to take more time experimenting with manipulation. The recording features of these apps were connected with students' brief engagement in pretense, wherein they entered play frames and created "as if" scenarios.

In addition to students' pretense play via interactions with imaginary situations (scaring fish, or enacting magic with colorful liquid) or creations of character-based recorded ‘shows,’ students also engaged in pretense with designs they had created. The next subsection includes examples of this type of pretense-related play.

Engaging in Pretense with Design Creation Apps

In addition to the manipulative play apps (*Pocket Pond* [2012] and *Fluidity* [2011]), and the three apps with character-based show recording options (*Toontastic* [2012]*; Sock Puppets* [2012]; and *Draw & Tell HD* [2012]), there were two other programs that elicited a few seconds of pretense play: *ABC Magnetic Board* (2012)*,* and the coloring pages in *Draw & Tell, HD* (2012). In the presence of these programs, there were two incidents in which students engaged their creations in a brief play frame that included dialogue. One of these displays occurred during Week Four as Vera engaged with *Draw & Tell HD* (2012).

> After spending six minutes adding colors to multiple line-drawing color pages in *Draw & Tell*, Vera noticed her tablemate adding props (hat, bowtie, moustache) to her color page. After asking for and receiving help with this task, Vera began adding different prop-stamps to her color page of a cat, dog, and mouse. She added a moustache to the dog, laughed, and pointed it out to her tablemate. After several additions (monocle, buttons, bunny ears, beard, hat) to the three animals, she heard her tablemate (not a study participant) using an affected voice to express her fairy girl’s (a line-drawing of a fairy) desire to have something to eat. Vera then scrolled through her own stamps, adding additional characters and voicing for them as she slid them up onto the page. As she added a caped mountain lion she said in a high-pitched voice, “ice-CREAM.” She added a bird and pipped, “I will NOT EAT…duuu duuuuu [singing]..” She added two more characters without speaking, then added a gnome as she said, “I’m a mister!” She then completed her image, looked at it, hit the back arrow, and began a new picture. She did not engage in any further verbal pretense, but spoke only about her design and hummed.

The second example occurred when Beth engaged with creating a picture with *ABC Magnetic Board* (2012) during Week Five.

> Beth looked at her image of snowflakes, holiday cookies, balloons, a gingerbread boy and girl, and presents and began singing to her tablemate, “Happy birthday to

> April, happy birthday to April, happy birthday to April, to April, to Aaaapril." As she sang, she pointed to her gingerbread boy and girl, and to the presents and then looked at her tablemate. She then continued to sing about a birthday as she scrolled through the magnet choices, then pulled her stylus back and started dancing as she sang. She added a bow magnet, finishing her song loudly, after which her friend laughed. Beth said, "That's what I call the baby rain." She returned to adding magnets to her picture (balloons of particular colors, flowers, butterflies) commenting only occasionally to name the items she was adding, until her friend led her to switch to another app.

In both of these incidents, each player seemed to create an "as if" scenario in which they voiced dialogue for characters. Vera briefly voiced dialogue for the characters she added to her screen, before quickly reverting to focus on selecting/adding/arranging props. Beth voiced the singing of "Happy Birthday" as she created her "party" scene, pulling together both her real-life tablemate, April, and her "as if" play frame of a party, as indicated by the gingerbread people, presents, cookies, and balloons. Both of these pretense-play incidents seemed brief due to the limited amount of talk observed.

Summarizing Engaging in Pretense

Through each of the pretense-play connected incidents, students took time to acclimate themselves to the manipulation of the icons and features of the program before stepping into a play frame. With some understanding of tool use and gestural moves, students engaged in pretense play in slightly different ways according to the affordance of each app.

In the manipulative/gestural exploration apps (*Pocket Pond* [2012] and *Fluidity* [2011]), children's play frames were evidenced through their actions and verbalizations about an imaginary situation. This was similar, in some ways, to Labbo's (1996) finding of children using the "screen as playground" and engaging in "symbol dependent" play in which symbols are "given a real world referent" (p. 369). Students used "fish" icons as symbols representative of actual fish they had to scare away. They also used "transfigurative symbolisim" (Labbo, 1996) transforming swirling water into a tornado, making things "powerful" by swirling a finger around the "colored liquid", or transforming themselves into superheroes while swirling fingers around the screen that appeared filled with this same "colored liquid".

In the presence of show-recording apps (*Sock Puppets*, 2012; *Toontastic*, 2012; *Draw & Tell HD*, 2012), students' play frames and pretense seemed to occur during the time the recording function was turned on, and was constrained by the available backgrounds, characters, and students' abilities to manipulate the characters while simultaneously creating dialogue. The short play frames and narratives they composed were evocative of Labbo's (1996) "screen as stage" approach. As with Labbo's students, the children could create a backdrop, characters, and narrative, but were often constrained in some ways by the available options. Labbo notes the stage events are often non-linear, "At times there was no beginning, middle, and end, but more a sense of captured fragments of dramatic play that appeared to be inspired by the availability and manipulability of clip-art icons and stamps" (p. 370). Indeed, the students in the current study seemed to evidence similar positions as Labbo's participants, given the contextual distinctions of a different device (iPad rather than a computer) and different programs (show-recording apps rather than drawing program).

In the design-creation apps (*ABC Magnetic Board,* 2012, and *Draw & Tell HD*, 2012) the play frames occurred as students created pictures and verbalized character voices. Two particular examples of this occurred within specific contexts wherein a player took up pretense that had begun with a tablemate in a parallel app (Vera), or used enactment of character to gain the attention of a fellow player (Beth). Much like the research of children's play at the writing center (Dyson 1987, 1988, 203) these students moved dynamically between pretense and the creation of a “text”—although the text in these examples were digital image texts.

Review of the verbalizations in most of the engagement in pretense examples indicates that students’ utterances were more often sound effects than dialogue, and many of the incidents indicate a fighting/rough-and-tumble play theme. Pretense-related play dominated by sound effects (Garvey, 1990) and rough-and-tumble (Jones, 1976) or superhero play (Boyd, 1997; Bauer & Dettore, 1997) has been observed by researchers in non-digital play, but has not been oft investigated in digital play contexts that allow opportunities for children to create their own play-frames.

The longest, most sustained examples of pretense-related play seemed to occur when two players shared the same iPad, or in one instance, when they engaged in the same play frame on parallel iPads. Shorter examples occurred when individuals created their own imaginary play frame and briefly enacted characters’ conversations. These briefer pretense scenarios were often followed by students’ experimental play with other features of an app, or movement to other apps. Overall, the amount of time spent in pretense-related play by students appeared very limited (20 incidents out of 374 total incidents) compared with the amount of time they spent with the manipulative engagements of playing to sample and playing to experiment.

The three ways students in this study approached and engaged iPad apps—sampling, experimenting, and engaging in pretense—have been explained through actions taken by students with only brief explanation/allusion to the contextual influence on student choices and play. Because children’s engagement with open-ended tablet apps is a new area of study, it is important to note the kinds of actions and behaviors students engaged in when encountering these new-to-them, open-ended iPad apps. However, my close look at the behaviors and actions of children in the presence of new technology can yield only a limited view of the complexity of students' experiences. The players' choices, actions, and interests never happened in isolation, but were situated in a context in which individual interests and social interests were complexly intertwined. Constant comparison of students' choices and actions revealed that classroom organizational and social factors were an inherent part of their technology experiences. Close examination of students' interactions indicated that the classroom environment and the interaction between the two tablemates seemed to influence the dance of individual and social interests and appeared to strongly influence the trajectory of the play. In the next section I discuss how sampling, experimenting, and engaging in pretense were influenced by the social context including teacher beliefs and actions, classroom context, students' individual interests and social influences that occurred via pairings of students in the iPad center.

SOCIAL CONTEXT: INFLUENCES ON CHILDREN'S DIFFERENTIATED PLAY ACTIVITIES

Students' choices and actions in this study occurred in a unique social setting organized by the teacher and simultaneously influenced by all the students in the class. The larger school structures affected this classroom as well, though only description—rather than analyses—of these larger structures were gathered for this study. The larger school culture was one in which the principal allowed teachers some freedom in constructing and organizing their own curricular goals—especially in the lower grades where there was no state-based testing. In pre-kindergarten in particular, the teachers had the freedom to create their own schedule, lessons, and activities, and were allowed to include extensive amounts of time in which students could engage in free-choice, play-based activities. The teacher in this study was also involved at the district level in creating pre-kindergarten curriculum, and had many years of experience in early childhood education. These larger macro-level structures played a part in the choices children were presented in this particular study, but were not analyzed closely. Instead, I focused on describing and interpreting student choices and actions within one particular classroom context, with one specific teacher, in the presence of relatively new technology to which each child brought different experiences, interests, and proficiencies. In this section I share data on the multiple contextual influences at this micro-level, including teacher beliefs and actions, the classroom setting, students' personal and social interests, as well as a social phenomenon I observed and described as "reflexive tracking."

Context: Teacher Beliefs and Actions

At the time of the study, Mrs. Murray was a teacher with 20 years of teaching experience, with 18 of those years teaching pre-kindergarten. As noted earlier, Mrs. Murray indicated a high level of interest in participating in the study, and had participated in earlier classroom research. In the two years previous to the current study, Mrs. Murray had participated in a university-led, science-based research project in which she collected data and presented findings on students' hands-on science experiences. Further, she had assisted in writing district curriculum. Mrs. Murray indicated her interest in continuing her own learning as a teacher, and—having just acquired two iPads for her classroom—shared her interest in learning more about how her students might use them.

In order to better understand the classroom and curricular context that might influence student choices and actions, I conducted interviews with the teacher at the beginning and ending of the study. During the teacher interviews, Ms. Murray shared several beliefs that guided her classroom and curricular organization. She balanced multiple factors as she organized her classroom and lessons: the state pre-kindergarten guidelines, the school curriculum, the pre-kindergarten report card assessment rubrics, her understandings of children's developmental trajectories, her experiences working with children, her understandings of how to teach young children, and her goals for children. She explained her goals for students—admixed with multiple influences—as follows:

> I think my number one goal is that they have got to love school. They don't have to be here—this is a year they do not have to be here—and I want them to love school, and I want to slip some things by them that they don't even know they're learning. And you know, I want it to be, first of all, they've got to love school and be excited about it, because I cannot send them off to kindergarten already not wanting to be at school. So, that's my number one goal: they have got to have fun in the midst of learning—and that's really, I mean that sums up how I feel about things. I do think we have to . . . keep up—you know we talk about developmentally appropriate all the time but I think we've got to keep up because those [pre-kindergarten] standards are changing. Ah, we've got to, in addition to doing hands-on things that their little muscles are able to do, we've got to fit in some ABCs here and there because things are just being pushed down. So we've gotta fit it all in! And I want them to be, I want them to be good citizens, I want to send them off knowing how to solve problems, you know—things like that. To me, social emotional is—at this school—you know, because they're mostly academically okay, I think it's important that they are well-rounded.

For Mrs. Murray, it was important that her students love school, learn certain academic skills, develop their social-emotional skills and have fun in the process. When asked about how she organized her curriculum plans, she explained:

> You've got to teach what makes sense to them. You've gotta teach—I can't just throw in Fall because it's September. I have to wait until fall happens. That's a perfect example because in our curriculum Fall is in September, you know? But I can't do fall, I can really barely do fall now [November] because the colors on the trees are changing and the weather's changing. So I try to fit it [teaching topics] in when it makes sense to them. Sometimes you can't, sometimes you have to just blop in a little unit here and there, but they're all learning about customs at home—we're doing holidays around the world, which is a unit in our school curriculum. But, I'm in the midst of teaching that while also teaching about numbers and letters—you know fitting it all in. You've gotta integrate—you've got to integrate it all in.

Mrs. Murray felt it was important to present information to children in authentic ways so that they could better understand the material. Furthermore, she knew the difficulties in trying to juggle both thematic topics and academic skills in order to "fit it all in".

In addition, Mrs. Murray expressed the importance of young children's learning through hands-on activities as opposed to paper-based, didactic teaching exercises. She explained:

> They've got to make sense of it. I cannot sit them down with a worksheet and teach them 2+2, but if I get out 2 dreidels and then two more people came to play with dreidels as well, you know we need four dreidels. It's got to be concrete, and it's got to make sense to them. They've got to be able to build on what they do with their hands. And if they don't have the skills to write things and they don't have the skills to read things, it's got to be in a way that's appropriate. And I think that if you can get the behavior out of the way, and let them play, and figure out a way to play in a constructive way, then I can slip in some ABC's and some other stuff here and there. I can get all that in. But if you can get the behavior out of the way then that's not in the way of their learning those things in the midst of their play. And so that's how I feel about hands-on and all of that. And it's got to be fun! They don't want to sit down at tables and work—I don't want to sit them down at tables and make them work.

Her use of hands-on, manipulative activities was connected to her beliefs about the importance of including opportunities for children to learn through play. This was held alongside a belief about play as an activity that was "fun" and different from work. Thus, she planned for activities she felt allowed for active student engagement, manipulative play, and fun as opposed to those that required students to "sit down at tables and work".

When discussing more about her goals for the students in her classroom, she indicated that she wanted children to be able to solve their own problems, to figure out how to get along, and to work together.

> My philosophy in all of the centers is: figure out a way to get along. If you're in a center and you're feeling crowded and someone's stepping on all the things you wanna play with, come back later—we'll have these toys out a long time. That's just to me a life lesson, you know? I don't do—the district would like us to do the

> center monitoring where you have them take their clip and put it on the wall and then only four people can go here, seven people can go here, three people can go here, and monitor the centers that way. It drives me crazy because it fosters bullying—I can't stand it. It fosters bullying and kids will exclude other kids, some will rush over and say, "Come on hurry, put your tag on," so another kid won't get to go over. And they will just stay there and look—and it's, it's power. It's power to have your tag on there, and um, I don't like that so I don't do it. And the district has been—the supervisors have been very, very supportive in letting me say that. So you see how cohesive we are. For the most part we do not have, we don't have battles really. I mean, we're four, but for the most part if I say, "Figure out a solution," at this point of the year they are mostly figuring everything out. At the beginning I do have to model a lot, "Okay, let's talk about this. You want a turn and you want a turn, what could we do about that?" And [I] help them learn to problem solve. But by this time of the year, "You need to get along or you need to step out of that center."

Her extensive teaching experience and her knowledge of young children were linked to these beliefs about how she organized her classroom centers her ways of supporting students' interactions within and around these centers. These factors may also have contributed to her ability to share her perspective with her supervisors, and to be allowed to organize her centers to fit her beliefs and understandings about children. She modeled for students how to work out their interactions in inclusive and cohesive ways, and then expected students to "figure out a way to get along".

These examples evidence some of the beliefs that influenced Ms. Murray's teaching and classroom organization. For this teacher then, the classroom was to be a place where students could explore, learn academic and socio-emotional skills, and do so through "fun" and "hands-on" activities—play perspectives echoed by other researchers as well (Moon & Reifel, 2008; Ranz-Smith, 2007; Taylor, Rogers, Dodd, Kaneda, Nagasaki, Watanabe, Goshiki, 2004; Taylor, Samuelsson, & Rogers, 2010). She planned her lessons carefully, keeping in mind the state guidelines, district curriculum, and child development, as well as her own years of experience and her goals for her students. Her beliefs were influenced by multiple discourses, and she worked to appropriate those discourses in her own unique way (Goldstein, 2008), seeking to balance play, fun, and academic skills. While there surely are other influences on her classroom organization, these were the ones that she mentioned explicitly in the interviews. It is to the classroom setting, as organized by Mrs. Murray, to which we now turn.

Context: The Classroom as a Space for Play

In addition to state guidelines, district curriculum, and the teacher's curricular planning and teaching goals, the students' actions and choices were also influenced by the classroom organization and schedule. Mrs. Murray structured the daily schedule as follows: students arrived and participated in a teacher-selected table activity (e.g., journals, name writing, pattern blocks, etc.), followed by puzzles/book time, large group circle time, student free-choice center time, outdoor recess, storytime, lunch, large group circle time, storytime, rest, outdoor recess, student free-choice centers, review of the day, and dismissal. This daily schedule was altered slightly on days when the students had additional activities to attend (e.g., library, computer lab, school assemblies). During the large group times the teacher led the discussions—sharing books, thematic activities, academic concepts, and new center options—but allowed much space for students to verbally share their thinking and ask questions. When it was time for free-choice centers, the teacher called one student at a time to stand and move to their desired center. During the student free-choice center time, students had a range of tables and areas from which they could choose: science manipulatives, math manipulatives, dramatic play, blocks, book nook, classroom iPad, art areas, sensory table, painting (occasionally), as well as a teacher-led center (or sometimes two) that were often optional but sometimes required. It was during this time that students could also choose to come to the iPad station.

Although students did have the freedom and time to make choices about the activities in which they wanted to engage, Ms. Murray did take time to give children a few hints before she released them to a new center. Thus, while they had choices, they also had guidance on how to engage with new activities in acceptable ways. Any time a new center was introduced, Mrs. Murray explained how to use items in the new center, and hints on some possible issues that might arise. For example, during the first week of my classroom observations, Mrs. Murray used a globe and a flashlight to represent light on the earth during daytime and nighttime. After a class discussion about the sun (exemplified by the flashlight) and how it shines on the earth (represented by the globe), and about daytime and nighttime in different parts of the earth, she discussed how students could engage with the globe and flashlight during center time. She carefully explained how to use the globe appropriately, and how students could help each other to spin the globe carefully and slowly. She modeled how students might respond if they witnessed another friend spinning the globe too fast:

> You can take care of it and you can say, "Please spin it slowly." If someone is spinning it too fast, do you come tell Mrs. Murray? [Students responded in chorus, "Noooo."] No. Unless you tell them 4-5 times and they do not stop, then you can come tell me.

Thus, students had the freedom to explore the globe and flashlight at the science center, but had to do so in ways that followed the classroom rules and expectations, which included taking care of the classroom objects and not spinning the globe "too fast".

Later that same week, after sharing a book about a bear and his shadow, Mrs. Murray used a flashlight and a paper bear shape to demonstrate how the sun could be positioned to cast a shadow. She explained that during center time there would be a shadow activity in which students could use an overhead projector and position their hands or bodies in front of the light, or place objects on the projector glass and observe their shadows. She explained that the projector worked best when there were two children there at a time, and that they could work together to "figure out how you both can be happy." She suggested one possibility: students could take turns, and those watching/waiting could write their name on a paper to indicate their desire for a turn. She suggested that students take 5 minutes per turn, and allow everyone to try once before visiting a second or third time. As in the flashlight/globe example, the students had the freedom to visit (or not) the shadow center, but with guidelines as how best to allow all to participate.

In a third example that same week, Mrs. Murray also included a center in which students could, if they desired, make a feeder for squirrels or birds who might be looking for food as winter approached. The feeder consisted of string-laced pinecones to be smeared with shortening and covered in birdseed. She explained that the students could add both shortening and seeds to the pinecones in whatever way they wished, but cautioned them that the pinecones were "kind of poke-y" and thus students might have to handle them gingerly in order to protect their hands. Again, Mrs. Murray was offering choices while simultaneously sharing information students needed in order to understand what new objects were available and how they might best approach these new objects. Students had the freedom to choose the activities in which they would participate, but also had guidance from the teacher about how to respect the materials, to work together, and to stay safe.

In addition to the thematic centers the teacher added each week, the students also had access to continuous centers that stayed the same, for the most part, throughout the study. These centers included the dramatic play center, block center, puppets, math manipulatives, books, puzzles, classroom iPad, and art activities. Occasionally, the teacher added new items to these centers, such as trucks and cars to the block center when the students studied transportation, or an ocean bubble in the dramatic play center when the students studied ocean creatures. New items in ‘old’ centers elicited much buzz in the classroom with many students rushing over to explore the new objects. Once the newness wore off, a few interested students would continue to return and explore with the new objects, while others often returned to engaging with their ‘old favorites’. For example, during the second week of the classroom observation period, Ms. Murray re-opened the dramatic play center with new holiday clothes (having just removed a tipi, instruments, and stuffed wild animals which had been in the dramatic play center for two weeks previously). Two boys who were usually observed building things in the block center—Wayne and Glenn—ventured into the dramatic play center on this first day with “new items” but soon returned again to their familiar favorite and oft-visited block center. Maya was another student who liked to be the first to try new things—from painting fall leaves, to playing holiday games, to making holiday print cards, and was even first to the iPad station. But she too had a center to which she returned repeatedly: the puppet center. The teacher’s classroom organization of introducing a few new items/centers each week and retaining other familiar centers offered children both novel and familiar choices during center time.

New items often attracted students’ interests, but newness wasn’t the only draw to a given center. In addition to new objects, other students sometimes influenced students’ choices. While some students (e.g., Lela, Glenn, Tony) often chose centers on their own, interacting with other students intermittently as they joined the area, other students carefully watched what centers friends chose and followed them repeatedly. For example, Simone often chose to play “birds” with her good friend and engaged in this activity every week of the study. In another example, Juan and Will often followed each other to centers (e.g., blocks and the art table to make paper airplanes) throughout the study, as did Vera and Marie, returning repeatedly to the dramatic play center and art table. Thus, sometimes friends influenced each other's center-time choices.

All of these elements—the daily schedule, time for student-led center choices, a variety of activities, familiar and new centers, and student social interactions contributed to the choices students could and did make during free-choice centers. In addition, the teacher's goals for student independence, social cohesiveness, and students' engagement and enjoyment of school and learning influenced how she organized students' choice time, just as her curricular goals and knowledge of child development influenced the center objects to be made available to students. As with the teacher in the study by Moon and Reifel (2008), this teacher also provided time, materials, opportunities for student choice and exploration, and created a classroom culture in which children could engage in peer learning and teaching. It was in this setting that the new iPad center was introduced, and in this setting that students explored and experimented with the various apps made available. To this setting, students came with their own personal and social interests, to which we now turn.

Context: Navigating Personal & Social Interests

I linked students' choices across and within apps with their navigation between areas of personal and social interest and disinterest. The context of free-choice centers allowed students time to select activities of interest to them, and this allowed me to interpret children's choices of the iPad center as registering a personal or social interest around trying play opportunities afforded by the research iPads. Although many students did choose to come to the iPad station, there were weeks during which some students chose not to visit the center and instead engaged in other activity centers. Unlike the students in Wang & Ching's (2003) ethnographic study of first graders' social engagement around computers, when my study participants were asked to select their initially desired center, the iPad station was not always students' first choice. For those who did choose the iPad station, however, there was a range of apps to choose among, with different sets of affordances. Students could both make choices about which apps might offer play opportunities of most interest to them, and change their minds. Players sometimes indicated their personal interests by asking for specific apps, as for example, Tony, who asked repeatedly across visits for which apps he could use "to make a show," or Simone, who said she wanted to play "the magic one," or Wayne, who said he wanted to "scare the fishies." At other times, students did not verbalize their personal interests in certain apps, but rather registered those interests by returning repeatedly to the same app both during a single sitting and across visits. For example, across the study, Simone returned to *Fluidity* (2011) 11 times, Beth to *ABC Magnetic Board* (2012) 11 times, and Wayne to *Pattern Blocks* (2012) 9 times. In addition, some students indicated their personal interests by spending long periods of time with a given app over the course of the study, such as Cherry, who spent over 52 minutes of her total iPad station time across the five weeks (72 minutes) coloring line drawings and creating images in one app—*Draw & Tell HD* (2012), or Beth, who spent over 41 minutes (88 minutes total) creating designs with *ABC Magnetic Board* (2012). Perhaps because these apps were open-ended apps (rather than "game" apps), and possibly because students had lengthier time allowances at the iPad station, these students' personal interests were different from Wang and Ching's (2003) participants who indicated interests to "playing the game for as long as possible and getting to the highest level" (p. 348). Rather, students in this study seemed to be interested in exploring, experimenting, engaging in pretense, and sometimes engaging in longer periods of creation/composition.

Compiling data tables that displayed students' varying amounts of time spent with each app made possible both close examination of individual students' choices and engagement, as well as comparisons across students' preferences and approaches. Reviewing incidents that lasted for short periods of time, as compared with lengthier incidents, yielded a continuum of engagement that could be related to features including program affordances, students' own interests, and/or the influences of peers. Although Couse and Chen's (2010) review of literature indicated children's higher interest levels and more sustained engagement in computer-based activities, researchers continue to investigate children's levels of engagement within computer- or tablet-based play. In a recent study, for example, Stephen, McPake, Plowman, and Berch-Heyman's (2008) found that children would not engage with technology play if they found the devices and/or games were too difficult to manipulate, boring, too long, or beyond their comprehension. In order to examine some additional possible influences on students' engagement and possible links with the approaches they took, I reviewed play incidents for actions linked to students' relatively shorter lengths of time spent playing with a particular app. I examined play incidents that lasted for under a minute, looking for the possible influences on children's choices to close an app after only short engagement. I then compared these with play incidents that were longer in duration. Strands that emerged for the students' varying involvement across a continuum of engagement levels included students' navigation across levels of disinterest versus interest, navigation across levels of socially influenced or personal curiosities, and navigation through technical difficulties.

Context: Navigating Personal Interest/Disinterest in App Affordances

In some instances, students' lack of engagement with an app appeared to be connected to their disinterest in a program and its content and/or affordances. The following examples describe incidents in which students opened a program, looked at it for a moment, and then closed it within a few seconds. In some cases this occurred silently, with few gestures, and in other cases it included verbalization. Recall the sampling example in which Juan appeared to be disinterested with the program option of making or looking at books. I inferred disinterest based on his actions of short and quick scrolling/scanning, his verbalizations that they are "just books" and his subsequent action to close the program and suggest a different one. In another incident, Glenn followed the lead of his peer, Tony, by opening the same app *Draw & Tell, HD* (2012). Glenn, like Tony, scanned through the available thumbnails of completed images, but then said, "No!" and closed the program. Glenn's sampling of this app, and his limited engagement with it seemed connected with his lack of interest toward the available program options.

Some incidents revealed the rapid changing of children's interests and engagement. For example, during a Week Five visit, Tony looked at the available choices on his home screen and then selected the *Fluidity* (2011) app.

> Tony exclaimed, "Ooh, I wanna do this one!" He swirled his stylus in a circular direction, and watching the colors of the "liquid" and "bubbles" change, and exclaimed, "Whooo! I'm playing this game" to his tablemate, Marie. She glanced over and then tapped open the *Magnetic Board* app and responded, "Not me, I'm doing this game!" As Marie moved objects on her screen, Tony tapped and held his stylus, then swirled it in a circle again. After a couple of seconds he reached over to tap the home button, turned his iPad toward me and asked, "Okay, which one is the game that um, that um, that does, that um, that plays…which is the game that plays back your, ah, your drawing?" I pointed to the *Doodlecast* app icon and he turned the iPad back toward himself and tapped it open.

Tony's engagement with *Fluidity* (2011) lasted only 20 seconds before he closed the program and asked about how to find the program he next wanted to engage in—the game “that plays back your drawing”. His disengagement in *Fluidity* (2011) seemed to arise as he remembered another game wanted to play. A similar situation happened later in the same sitting when Tony, having just finished recording and playing back his drawing in *Doodlecast* (2012), closed the program and asked about a different program.

> Tony asked, “The coloring paper button – where is the coloring paper button?” Not knowing exactly which game he meant, I explained there were several games that allowed a user to change backgrounds/coloring papers, including *Magnetic Board* and *Draw & Tell HD*. He opened *Magnetic Board* and I began to show him how to change the backgrounds, and he watched for a moment and then pushed the home button and said, “I wanna do like the COLORING paper, like where you color the PAPER…with the lines!” I responded, “Oh, okay, try this one,” and pointed to the *Draw & Tell* app icon. He opened it and looked at the opening screen. I pointed to the “select a coloring page” icon and said, “Are you thinking about this one?” He tapped it and saw the line drawings that could be filled in with color and responded, “Yes! THIS one!!”

Tony had been earlier engaged in recording his drawing, but once finished, he verbalized his new interest in playing the ‘coloring paper’ game. When he tried the *ABC Magnetic Board* (2012) app, he immediately showed his disinterest in engaging with this game as it wasn’t the one he was looking for. His interest in a specific ‘coloring paper’ game seemed to trump his earlier interests and engagement with the previous app as he turned his actions to engage with a new app.

Students’ more brief engagements with an app were connected with sampling, while longer engagements were linked with experimenting and engaging in pretense. It seems that one reason students may have sampled an app briefly was due to their level of personal interest in a given app. Some incidents, however, revealed students’ interest in a tablemate’s actions, which suggests engagement was not only linked to individualized personal interests, but could be linked to curiosities derived from interpersonal influences.

Context: Navigating Socially Influenced Curiosities

Another contextual variable that seemed to be linked to children's levels of engagement in play with an app was students' interests in following (or leading) one another in choosing games. As students made their choices, they navigated between personal curiosities and socially influenced ones. For example, in the "just books" incident shared above between Juan and Wayne (in which Juan exits an app quickly because they are "just books"), Wayne demonstrated his interest to follow Juan's lead in selecting a different app, even though he initially seemed interested to explore more (as indicated by his excited verbalizations toward the screen). While Juan's reason for closing his program seemed to be his disinterest in books, Wayne's initial excitement was modified when Juan impelled him to try other programs. In fact, throughout their time together during this particular visit, Wayne often closed programs in order to follow Juan, and it even seemed to turn into a little game between the two boys. Throughout their time together these two friends alternated taking the lead in suggesting games to play at the same time. During this visit the two boys spent 20 minutes at the iPad station, in which I recorded 15 incidents for Juan, and 12 incidents for Wayne, yet all around the same 8 apps.

> With only a few seconds of difference between them, the boys engaged with the same apps for the majority of the time. They took turns suggesting which app to play next with the progression as follows: Juan suggested the first game (*Scribble Press*), Wayne suggested the second and third games (*Pocket Pond* and *Doodle Buddy*), Juan suggested games four through seven (*Pattern Blocks*, *Draw & Tell*, *Pattern Blocks*, and *Pocket Pond*), Wayne suggested the eighth game (*ABC Magnetic Board*), Juan suggested the ninth game (*Draw & Tell HD*, but Wayne didn't want to quit *Magnetic Board*…he eventually did follow Juan into *Draw & Tell HD*). After a brief diversion of app choices between the two players, Wayne then suggested *ABC Magnetic Board* again, and finally Juan suggested revisiting *Pocket Pond*.

Six of Wayne's 12 incidents indicated brief engagement, and 9 of Juan's 15 incidents indicated brief engagement. The boys appeared to be following one another into the same apps for the majority of the time. For these two friends, their desires to follow each other and briefly explore the same games were linked to play forms in which it appeared they were sampling a variety of programs together. Their sampling seemed to be socially influenced.

In these examples of socially-influenced curiosities about apps, students' engagement with an app seemed connected in some way to their interactions with their tablemate. Lengthier engagement with apps could also be connected with social interests, as indicated in several of the experimenting examples wherein students both experimented and composed alongside one another, using reflexive tracking to gather ideas from one another. For example, Marie and Vera engaged in reflexive tracking as they shared ideas while composing images with *Pattern Blocks* (2012). Likewise, Cherry and Vera gathered ideas from one another as they designed color arrangements for line drawings in *Draw & Tell HD* (2012). Whether sampling or experimenting, students navigated social interests as they made choices to either suggest a new app or follow their peer's suggestion. However, players did not always accept a suggestion. When Juan tried to force Wayne to follow him to opening the app *Doodlecast* (2012) (by reaching over and tapping Wayne's home button and then tapping on Wayne's *Doodlecast* icon), Wayne responded, "Nooooo, I picked that one!" He then pushed Juan's hand away and re-opened the app in which he was creating a design, *ABC Magnetic Board* (2012) (though he quickly finished his design, opened *Doodlecast* (2012), and began drawing the same image as Juan). Further, students did not always consciously lead. Even so, the characteristic of leading/following seemed at times to be an influence on students' play choices. As in other studies of children's social interactions and influences on one another when experimenting or creating side by side (e.g., Rodriguez, 2009), the students in this study could be influenced to take up a different app when they witnessed a tablemate doing so.

Context: Pursuing Personal Curiosities

In addition to navigating social interests, there were also incidents in which students pursued curiosities. One behavior I linked with students' pursuit of personal curiosities was a searching behavior, evidenced by actions that indicated a child was searching for something specific. There were several incidents in which students rapidly opened and closed programs in what appeared to be searching behaviors—an intent evidenced by their verbalization of what they were looking for, or merely indicated by their scanning eye-movements and hovering finger movements. The searching behavior was sometimes linked with students' looking for specific programs they had played in another space (e.g., the classroom iPad or an out-of-school touch-screen device), or looking for programs they had previously played at the iPad station. Other times, students searched for something they created, and still other times they searched for something another person created. Many times students searched for a program their partner was playing. Several examples elucidating these different types of searching behaviors follow.

One type of searching behavior involves students looking for a particular program they played in another space (an app not on the study iPads). For example, during Week Two, after several sampling play incidents, Maya scanned her finger over the choices, saying, "Now I want to do…, ummm…" She then tapped the *Doodlecast* (2012) icon.

> The program opened and Maya swiped her finger in a small circle on the screen before pushing the home button again. "Wait, I wanna do the frog one that catches frogs." She looked at all the choices on the home page and finally tapped

> on *Pocket Pond*. She started tapping the 'water' saying, "I wanna do the frog," and then tried several gestures: sliding her finger across the screen, pinching at the swimming fish, using both hands to tap the water, reverting back to tapping with one finger. She tried these gestures for 35 seconds before closing the program and saying, "I'm gonna do a different one." She looked at the screen and then leaned back and said, "I wanna do this…I wanna do the different one." A few minutes later after exploration of other apps, she again asked about the "frog" game: "You know, the one where the frog [she sticks out her tongue and points to it] catches the flies on his tongue."

In this example, Maya was looking for a specific game with which she was familiar, having played it outside of the study's iPad station. Review of incidents revealed that this type of searching associated with looking for games played in other spaces typically occurred during the first two weeks of the iPad station as students sorted out how the new center's iPads were similar and different to the classroom iPad and to their own out-of-school touch-screen devices.

A second type of searching behavior included students' search for games they had played at the iPad station. In one Week Two example, Sofia closed her recently opened *Doodle Buddy* (2011) game and started swiping through the home screens asking, "Can I do the puppets?" This was a game that was originally on the center's iPads (during the first four days), but was removed due to research recording difficulties. However, it was a game the students remembered and liked, and Sofia was not the only one who searched for it. On another day during Week Three, Maya closed the program she was working in and scrolled through the home screens to announce, "I wanna do the puppet game." On still another day during Week Four, after a few moments swirling his stylus around in *Fluidity* (2011), Tony pushed the home button and said, "Can I tell you something? Which is the game, where is the puppet game" as he scrolled through the home screens. Each of these students was searching for a specific game they had played and enjoyed during an earlier visit to the iPad station, but due to research-recording related difficulties had been removed from the rotation of available apps.

In another search for an earlier-played app, during Week Two, Cherry began looking for a specific program.

> Cherry examined the icons on the home screen and stated, "I wanna do that girl thing." She then tapped open *Doodlecast* (the first icon on the top row), looked at it briefly then tapped the home button. She next tapped *Pattern Blocks* (the first icon in the second row), slid over a couple of blocks, and then tapped the home button again. She next double-tapped the home button and the screen raised up to reveal the icons of all the open programs. She hovered her fingers over the choices and tapped the *Doodle Buddy* icon. When the program opened, she tapped in the center of the screen and a dot appeared. She looked at it briefly, then pushed the home button again and scanned the icons visually. She next tapped the second icon on the top row, which opened *Draw & Tell HD*. She tapped the icon that revealed thumbnails of completed drawings, scanned until she found one of a fairy girl, then tapped it open and began to add color.

In this example, Cherry appeared to be looking for a specific thing, "that girl thing" and sampled three different programs before she finally found the one she was searching for. When she found "that girl thing" she settled in and experimented and created for an extended period of time. Thus, it appears that her personal curiosities to search for a specific thing influenced her brief engagement with several apps, but once her desired app was found she engaged for an extended period of time.

Sometimes students did not verbalize which app they were searching for, but their actions indicated searching behavior. On one occasion during Week Four, Vera exhibited searching behaviors when she methodically opened five programs, looked at each briefly, then closed the program. She began to query, "How do you, um, get to…um…" but did not complete her statement. Instead, in rapid succession she began from the top left and quickly opened, examined the screen, and closed five apps in a row. Unfortunately, the timer sounded before she found what she was searching for, and as soon as the timer sounded she stopped and pulled her stylus away from the screen. She was searching for something specific, but due to the lack of time was unable to find what she was looking for. Her brief engagements with multiple apps seemed connected with her personal curiosities and interests in finding a specific thing.

A third type of searching behavior was exhibited when students were searching for a product they had previously created. Some apps offered in-app saving capabilities, and others did not. One of the apps—*Draw & Tell HD* (2012)—had an automatic saving feature built into the game: a tap on a square, red icon on the app's main-screen would reveal all the drawings and recordings attempted. Another app—*DoodleCast* (2012)—had a saving function that enabled a user to save his/her recorded drawing to the iPad photo stream. For the remainder of the apps, if students wanted to save their created images, they had to take a screen shot (via simultaneously depressing of the home and power buttons). When students asked about saving their creations, either a tablemate or I explained and/or demonstrated directions for taking a screen shot. Once students discovered this was possible—and that they could look for their created images in the iPad photo stream (available by the *Photos* app, represented by a sunflower icon)—they often began alternating between creating/capturing screen shots of their designs and searching for their screen shot in the *Photos* icon. The bulk of Beth's brief engagements were of this type; on multiple occasions she went through repetitions of creating an image in a given app, taking a screen shot, switching over to *Photos*, scanning for her photo, then re-opening the previous app and either adding more items to her picture or beginning a new one. This pattern of making, documenting, looking for evidence of her documentation, and re-visiting/adding to the original creation happened 10 times with this student. Her searching behaviors involved looking for photos of her created works. Other students also engaged this same making/documenting/looking behavior several times. This type of searching happened most often once students learned to take a photo and scan the photo albums, and was linked to students' sampling of the *Photos* icon.

Finally, students also exhibited searching behavior in relation to searching for the app a peer was playing. This could be connected either with sampling, as students tried to follow a peer's quickly changing interests, or with experimenting, as students searched for the identical app played by a peer, and then settled in to experiment via testing, practicing, and/or composing on their own.

Context: Navigating Technical Difficulties

Another possible contextual influence on students' engagement levels with apps was connected to technical difficulties wherein either the player had problems navigating the app, or the app itself malfunctioned. As with students in Couse and Chen's (2010) study, there were instances in which children encountered technical difficulties that inhibited their continued play. In the current study, difficulties arose from a variety of sources, including program tools with text many children couldn't read, gestures that resulted in pop-up boxes with more text, icons and tools that might be difficult to interpret, and even program malfunctions.

Several examples of program malfunctioning occurred during Week Four, when Marie first opened *Doodlecast* (2012).

> Seconds after opening *Doodlecast*, Marie tapped the screen to begin a drawing, after two taps the program closed inadvertently, after which she chose to open the program right below it rather than re-open the "malfunctioning" program.

In this example, Marie didn't make moves that caused a problem, but instead it seemed the tablet just froze up during her interactions. Rather than try again, she instead selected to engage with a different program.

In other instances, students took actions that resulted in program responses that inhibited further engagement. In one example during Week Three, Maya opened *Scribble Press* (2012) but after tapping in several places on the screen she couldn't get the pop-ups to disappear. Therefore, since the program didn't appear to work and/or she had user difficulties in manipulating it, she closed it and tried a different program. In another different example, Topher tapped the screen with five fingers, which resulted in a zooming-in of the screen that he couldn't correct on his own. These two brief instances demonstrate student-moves that brought about unwanted results. Many times when students didn't know how to solve a problem, they just depressed the home button. They might then re-open the program to see if the problem resolved itself, but sometimes students would just moved on to a different program altogether.

There were also incidents that indicated students' repeated attempts to try and work through technical difficulties. One such example occurred during Juan's first visit during Week Two, as he engaged twice with the program *Pattern Blocks* (2012). After 35 seconds of sliding several blocks from the palette to the design-area, Juan announced he was done and closed the program. Just then, he glanced at his peer, Wayne, and saw pen marks in Wayne's *Pattern Blocks* (2012) image.

> Juan exclaimed, "How did you write?" In trying to re-open the program, Juan pushed the wrong program icon, then got distracted by another game for a moment before trying to re-open *Pattern Blocks*. He tapped at the icon 8 times before it opened (due to a slight tap and slide motion of his finger), and the screen opened to his earlier scattered blocks. He tried tapping on one of the pens in the bottom of the screen and swiped his finger but no marks appeared. He reached down with both hands, tapped the pen with one hand and drew with the other. He slid his finger around the screen, which resulted in a long, blue, curvy line scrawled across the screen. He heard Wayne and me talking about how to erase and he noted, "I want to erase it. . ." He saw the trashcan in the corner and tried tapping it, but nothing erased and blue dots appeared on top of the trashcan. He said, "I'm tapping it…" He looked over at Wayne's screen, turned to his own again and tapped at the trashcan several times, then said, "I'm not doing this." He

> looked at his screen again and tried tapping the trashcan once more, "I'm tapping the trashcannnn, not happening!" He looked over and saw me tapping on the "Clear All" icon on Wayne's screen so he pressed one of two icons on the left side of his screen. A program pop-up box appeared with advertisements for other apps, so he pushed his home button and then re-opened *Pattern Blocks* again. The program re-opened with the pop-up still on screen. He looked at it, then tapped the home button again and opened a different game.

In both of these *Pattern Block* incidents, Juan tried to use a specific tool—whether a pen, or the trashcan—but had difficulties navigating the icons and the particular steps needed to have full control of the tool. Further, text-filled icons and pop-ups caused more difficulties that Juan could not navigate without assistance, so he quit the program and opened a different game.

In another example, Beth experienced difficulties during her fourth iPad station visit as she opened an app she had played three times before: *Doodle Buddy* (2011).

> As she sat down, she picked up the stylus and I asked if she and her tablemate, Maya, had used a stylus before. Maya said, "No," and Beth said, "Yeah!" so I asked Beth to explain to Maya how to use it. Beth squished the tip with her finger and said, "You're supposed to um, uh, push which game." She used the stylus to tap the *Doodle Buddy* icon on her own screen and said, "Like that…see? Push which game you want!" The screen opened to a snowy background with a snowman that was upside down. She reached up with both hands to perhaps rotate the iPad, then said, "Hold on…whoa…" She looked around the screen, hovered her stylus over the choices at the bottom and looked around saying, "This is nooot aaaappropriate, tsss!" She then reached and pushed the home button, "Okay…ha ha, that was so weird!" She examined her stylus some more, pushing the tip and looking closely at both ends, then pressing the squishy part as she turned to watch Maya play *Pocket Pond* for a moment before choosing her next game.

Although Beth had experimented with this app three other times for a total of over 12 minutes, she had not before encountered the snowy background, nor had she dealt with a background that was upside down. Due to technical difficulties, Beth's engagement was brief (a total of 10 seconds) and as she could not solve the problem, she closed the app and looked for a different game.

Program malfunctioning and actions that resulted in unwanted program responses did not happen often, but when it did it was sometimes connected to children's lessened engagement. However, there were instances in which students demonstrated resilience in the face of program difficulties and would continue trying multiple tactics to solve problems [as Couse and Chen (2010) found in their study as well]. Even so, technical difficulties emerged as one factor that sometimes inhibited play or resulted in shortened engagement with an app.

All of these examples and explanations indicate several properties influencing children's levels of engagement with open-ended iPad apps. Some of the conditions that appear to be linked to children's levels of engagement with apps included their level of boredom and/or disinterest, curiosity about other choices, interest in following or leading a partner to something different, interests in searching for something specific, and even the influences of program malfunctions. Children's shortened engagements with programs echo Stephen, McPake, Plowman, and Berch-Heyman's (2008) findings that children did not like to engage with technology play if the devices and/or games were to difficult to manipulate, boring, too long, or beyond their comprehension. However, my findings also extend our knowledge about children's brief engagements as they demonstrate additional factors that might come into play as children decide to end engagement with a game. Students' personal and social curiosities, their level of interest, and even technical difficulties were connected to children's level of engagement and play with an app.

One major difficulty in analyzing children's level of engagement arose when trying to tease apart personal and social interests. Personal interests were not the only factor linked to student choices and actions at the iPad station, but they were situated within a specific social context in which tablemates seemed to influence each other. Like the students in Wang & Ching's (2003) study, these participants also appeared to have social goals such as "socially belonging to the group, having fun with friends, and forming and consolidating friendships" (p. 348). In addition, there were instances in which students stopped engaging or altered their actions with an app they had selected or in which they were engrossed when they noticed something their tablemate was doing. Although students were engaged with their own individual iPads, they seemed to be aware of not only their own actions and choices, but the actions and choices of their tablemate. This keen awareness of other digital players, demonstrated across pairs, was evident across all levels of student engagement with open-ended iPad apps. The data gave rise to a phenomenon I have labeled the phenomenon, "Reflexive Tracking."

Reflexive Tracking: Maintaining a Sideways Glance

During the process of open-coding and constant comparative analysis of individual student behaviors and interactions during each visit to the iPad station, patterns emerged on the interplay between *personal* and *social* influences on student actions and choices in their play. During the first four days of iPad station data collection, these patterns went unnoticed, because students were vying for turns on a single iPad. The addition of a second iPad allowed pairs of students to sit at parallel, identically-prepared devices. In trying to better understand children's play, and noticing the changeable nature of this play, I analyzed the linear path of each student's program choices across each visit to the iPad station. I constructed data tables for each pairing of students and tracked the path of each person's app choices over the course of each iPad station across the entire study. For an example of the path tracking, see Table 11. This table indicates the linear path of program choices of three pairs of students during Week Three.

Table 11

Student App Choice Paths During Week Three (December 17)

Marie & Vera	**Juan & Will**	**Maya & Topher**
Marie – *DoodleBuddy* Vera – *DoodleBuddy* Marie – *Photos* Marie – *DoodleBuddy* Marie – *Photos* Marie – *Pattern Blocks* Vera – *Pattern Blocks* Marie – *Photos* Vera – *Photos* Marie – *ABC Magnetic Board* Vera – *Pattern Blocks* Vera – *ABC Magnetic Board* Vera – *Photos* Marie – *Photos* Vera – *ABC Magnetic Board*	Juan – *Pocket Pond* Will – *Pocket Pond* Juan – *Pattern Blocks* Will – *Pattern Blocks* Juan – *ABC Magnetic Board* Will – *ABC Magnetic Board*	Maya – *ABC Magnetic Board* Topher – *DoodleBuddy* Maya – *DoodleBuddy* Maya – *Pocket Pond* Maya – *DoodleCast* Topher – *Pattern Blocks* Maya – *ABC Magnetic Board* Topher – *DoodleCast* Maya – *Photos* Maya – *Fluidity* Topher – *Fluidity* Maya – *Scribble Press* Maya – *Draw & Tell* Topher – *Draw & Tell* Maya – *Pattern Blocks* Maya – *Draw & Tell* Maya – *Pocket Pond* Topher – *Pocket Pond* Topher – *Scribble Press* Maya – *DoodleCast* Maya – *Scribble Press*

As can be seen in the samples included in Table 11, there were occasions in which students followed each other's lead (or took turns leading and following) in trying new programs. For example, Juan opened *Pocket Pond* (2012) and his tablemate Will soon followed in opening the same app. After Juan opened *Pattern Blocks* (2012), Will followed and opened the same program as well. Finally, Juan opened *ABC Magnetic Board* (2012) and Will followed and opened the same app. While this tracking and following of app openings and engagements was observed at least once with every pairing of students, it occurred more often with some pairs than with others. It seemed to occur more often between students who were observed to play with one another in other parts of the classroom, although the lack of video cameras in every classroom center prohibited a deep analysis of who played with whom, for how long, and in what manner across classroom areas.

I next examined the actions and choices *within* a program, which revealed students' tracking of each other's ideas and actions not only at the level of program selection, but also at the level of tool selection and use. I decided to term this tracking of ideas that was connected with children's paths of play "reflexive tracking" and then examined individual incidents for its characteristics, both at the program-choice level and at the choice level once inside a selected app. Reflexive tracking centers around students' sideways glance toward the screen, actions, and verbalizations of their tablemate and their response to what they observed and/or heard.

I identified and labeled reflexive tracking in the data set in several ways. The most common method for detecting students' reflexive tracking in this data set was by observing incidents in which individuals overtly looked toward their tablemate's screen. In other incidents, I observed when students overheard their tablemate ask a question, make a comment, express pleasure or excitement, or make an explicit invitation for others to look at their screens. The observing student sometimes made verbalizations and/or took actions in response to what he/she had heard or witnessed, thus making the tracking behavior reflexive. There were other incidents in which students' observations of their tablemate's screen did not result in any verbalizations or visible response to what they saw and/or heard. These instances *might* be characterized only as "tracking," however, when students demonstrated a combination of tracking paired with some responsive action—indicated by verbal and/or physical response to what they saw/heard—I labeled these instances as examples of "reflexive tracking."

Reflexive tracking was a means by which students maintained a sideways glance on the screen, actions, and verbalizations of their tablemate and responded in some way to what they observed and/or heard. Reflexive tracking seemed to be a means by which students' social interactions were interconnected with their play choices. In most cases, students' reflexive tracking included a player's following of their tablemate's actions/choices, whether through parallel app choice, tool use, gestural moves, or use of similar design elements. In many cases reflexive tracking was acknowledged favorably by the tablemate, though on some occasions the tablemate ignored any parallel actions or verbalized entreaties, and in a few instances even expressed displeasure with the reflexive tracker's play choices to imitate his or her own play choices.

Reflexive tracking occurred at the program level as children noted their tablemate's app choices and made decisions about whether or not they might choose to play using the same app. Incidents occurred during which students were not initially interested in playing the same app, but soon chose to follow along. Other incidents occurred in which students actively sought to play the same app as a tablemate. One example of students' initially different play paths that later converged occurred during Week Four. Tony first chose to swirl colors in the app *Fluidity* (2011) as Marie began composing a picture using *ABC Magnetic Board* (2012).

> As Tony first began swirling the colors around on his screen, he stated, "I'm playing this game" (*Fluidity*). Marie countered, "Not me, I'm playing this game," (*ABC Magnetic Board*). The two continued opening and engaging individually with these and other apps until Marie heard Tony get excited about finally finding his desired game – the 'coloring paper' game (*Draw & Tell HD*). As Tony exclaimed, "Yes, THIS one!" and looked at all the line-drawing color page options, Marie looked from his screen to her own screen and said, "I wanna go there!" She tapped her home button and said, "Going away…" and then scanned her stylus across the home-screen icons and tapped open *Draw & Tell HD*. As the program opened she glanced between her screen and Tony's and said, "I picked this too, like…" and then looked for the same line drawings. When her first tap

> resulted in choices between different background colors, she tapped the "back" arrow and then tried the second icon, which revealed the line-drawing choices Tony had been perusing. She scanned the options and picked a fairy picture—different from the image Tony had chosen (jumping mice) but within the same program area as Tony.

Marie first began reflexive tracking when she noticed and verbalized her different choice from Tony's game choice. She then engaged individually with several apps until she heard Tony's verbalization, observed his screen, and took actions to not only open the same app but also to engage in the same activity: coloring line drawings. Although these two were not initially interested in playing the same game, when Tony verbalized his excitement over a game, Marie observed, verbalized her interest to follow along, and took actions to engage in the same activity (line-drawing 'color pages') within the same game (*Draw & Tell HD*, 2012). While Tony did not seem to evidence reflexive tracking in this incident—he seemed engaged in his own interests without noticing the actions of his tablemate—reflexive tracking was connected to Marie's changeable play interests in this iPad station visit.

Students' reflexive tracking instances were connected not only to their choices of which apps to play, but also the approaches they might take. In some incidents, children maintained sideways glances toward a tablemate and took up similar experimenting (or sampling, or engaging in pretense) actions. In one Week Four example, Maya and Topher began by exploring apps individually, but soon Maya followed Topher to engage the *ABC Magnetic Board* (2012) app.

> Topher engaged with *Doodlecast* while Maya engaged with *Draw & Tell HD*, and then *Pocket Pond*. Topher then switched to engage with *ABC Magnetic Board*. His screen was filled with magnets so he reached over and used the eraser-ball to erase the entire screen. Maya glanced over and stated, "I wanna do like Topher is doing." She selected the same app and it opened with a screen filled with magnets from a previous player's creation. Topher glanced at Maya's full screen and said, "No, you…let me help you," as he reached over with his stylus to clear the screen. Maya refused his help, pushing his hand away and insisting, "No I can do this."

> She started sliding magnets around and Topher watched stating, "Um, I need to help Maya," and again reached toward her screen. Maya pushed his hand away a second time and said, "No, I can do it myself!" Topher pointed to the little eraser-ball, saying, "The little bobble, that one…" Maya replied, "I can do it myself, I know, I know, I can do it myself." She continued to struggle with sliding magnets off so I pointed to the eraser-ball and told her she could erase all at once by pulling it down. After several tries, she finally erased on her own, and Topher exclaimed with relief, "Yeah!" Topher turned back to his own screen and began sliding up holiday magnets. Maya glanced over and switched from letter magnets to the same holiday magnets Topher was using. Each worked for several minutes on his/her individual images. Maya then turned to Topher and said, "Look what I made, Topher!" He looked and then looked back at his screen and stated his intent to take a picture of his image. Maya erased her image and quit the program just as I guided Topher in taking a screenshot. Maya stopped to watch and responded, "I wanna take a picture," as she re-opened the app, and quickly slid up five magnet-pairs to make a new design. She tried taking a screenshot but inadvertently closed the program and said, "Awww, I wanted to take a picture." I explained to her how to take a screenshot, and after taking one she said she wanted to play another game.

In this and subsequent incidents on this date, both Maya and Topher had instances in which they announced a desire to play the same app the other was playing, as well as instances in which they were drawn to similar actions when they saw their tablemate learning a new skill (e.g., taking a screenshot, getting a new background). Furthermore, Topher kept an eye on how he might help Maya, and though she refused his help, she kept an eye on his screen and selected the same magnet set for creating a picture. When Maya quit to play another app, her sideways glance at Topher's learning of a new skill (taking a screenshot) drew her back into the same app, and she learned the skill as well. Moments later, Topher switched games and followed Maya's lead to engage a different app. Later in the same session, Maya again noticed Topher doing something she found interesting—making a book—and stated, "I think I want to do that one." When she couldn't figure out how to work the program, she switched to another app—*Fluidity* (2011)—experimented with multiple gestural moves and eventually invited Topher to join her: "Look what I'm doing!" Topher quickly switched and the two experimented with multiple gestures and added quiet sound effects until center time was over. Throughout this one session, each person had moments of individualized work, interspersed with reflexive tracking, which was connected to their social interaction and their gaining of ideas from each other. Reflexive tracking between both players appeared to be connected to their changing play interests.

In addition to mutual reflexive tracking, as exemplified by Maya and Topher, there were also instances in which reflexive tracking was more one-sided, with one player attending more closely to the choices of another. One example occurred during Week Five, as Maya (who had engaged in intermittent reflexive tracking during Week Four with Topher) kept a close eye on what her chosen tablemate, Beth, did at the iPad center. Maya tried multiple tactics to invite Beth to play the same app as her, however, Beth was largely engaged in her own actions, only glancing over or responding occasionally when Maya invited her to play the same app or implored her to look at her screen.

> In her first moments at the table, Maya opened the app *Pocket Pond*, but after a few seconds closed the program and opened *Fluidity*, inviting Beth, "How about this? It's very fun!" Beth ignored her and continued making her own magnet picture in *ABC Magnetic Board*. While trying multiple gestures to swirl the colors, Maya touted the benefits of the program, "It turns purple and…every kind of color!" Beth turned to watch her, naming the colors as Maya swirled her stylus through the "liquid". "You wanna do that?" queried Maya. "Noooo," replied Beth, who then named more colors, "Red…yellow…purple…" before turning back to work on her magnet picture. Maya continued with this app for a few seconds, then experimented with *DoodleCast* for about a minute until Beth asked, "Maya, look at my picture, see—isn't it pretty?" Maya looked and then quickly switched her own tablet to display the same app. However, due to the work of a previous player, the program opened with a different background (Christmas tree) than Beth's plain grey background. Maya inquired, "Where did you get that?" The two tried to help each other sort it out for a moment but were unsuccessful in matching the background screens. Maya then forged ahead with the Christmas tree background and matched Beth's work by sliding up similar magnets (flowers and butterflies). Both girls continued their creations for a short time until Beth expressed joy at finding additional magnets Maya inquired, "Where did you get there?" Maya let Beth manipulate her screen (but kept her hand near Beth's) and

> implored, “I wanna go back there like you!” After Beth helped Maya find the same set of magnets, both girls continued working for a time adding magnets (although Maya soon scrolled to a different magnet set). She invited Beth to “Look at my Christmas tree” twice but Beth continued her own creation, telling Maya to “hold on”. Both girls returned to adding more magnets until Maya again invited Beth to look. Beth, fascinated by her own picture, ignored Maya’s invitations and instead said, “Maya, look at my picture!” She then pushed Maya’s hand away as Maya reached over to adjust a magnet on Beth’s screen. Maya responded by inviting Beth to look at her screen five more times, with no response from Beth. Maya then turned her screen toward Beth and asked a sixth time, “Look. Isn’t it pretty in here?” Beth glanced over for about a second and replied, “Yeah,” and continued working on her own design.

Throughout this session, Maya was more attuned to Beth and conversant with her even when Beth repeatedly ignored her and only offered brief acknowledgement of Maya’s invitations. Maya engaged in reflexive tracking, switching to play the same app as Beth, trying to find the same background, even using the same magnet set. She tried to engage Beth multiple times. Beth briefly engaged in reflexive tracking when she took notice of Maya’s work, but decided not to change her own play choices. There were some instances in which she seemed oblivious to Maya’s inquiries—perhaps not engaging in reflexive tracking, though she did occasionally stop her play to help Maya. While Maya’s reflexive tracking and her changing play path seemed connected to her interests to engage Beth, Beth’s reflexive tracking seemed only connected to noticing Maya’s play and then returning to her own personal interests. She seemed interested in helping Maya occasionally, but not in being socially open to interactive play with Maya.

On some occasions, students engaged in mutual reflexive tracking but then interests diverged, or were even resisted outright. In one Week Five example, Cherry and Vera were seated at the iPad station and Vera looked at the menu screen and tapped open *Draw & Tell HD* (2012) saying, “I’m doing this.” Cherry glanced over and quickly tapped open the same program. The interaction continued as follows:

Cherry reaches over to tap the coloring-page icon and then turns back to her own screen, announcing her intent, "I'm doing…food." Vera selects the same drawing, and then follows Cherry's lead by selecting the same tool, same color, and same part of the image to fill with color.

Cherry: [Humming] (Scrolls through the crayon choices, pauses, pulls her stylus away from her screen and looks over at Vera's screen.)

Vera: How do you do…

Cherry: You don't have to copy me, 'cause I don't…

Vera: I'm not copying you!!

Cherry: (Turns back to her own screen and taps pink, the taps a swirl of her muffin which fills with pink.)

Vera: Pink? Where's pink? I can do colors…(reaches to tap the rainbow crayon)

Cherry: (Pushing Vera's hand away from the rainbow crayon, she scrolls the Vera's crayons over) It's the last! No, it's the last one."

Vera: Okay. (Taps the pink crayon that Cherry indicated and adds pink to one of her muffin swirls.)

Cherry: (Adds additional colors to her muffin swirls)

Vera: I'm doing colorful…(Scrolls back to the rainbow crayon, taps it, and quickly taps the individual sections of her muffin a different color.) I'm doing the color.

Cherry: (Glances over at Vera's screen and adds similar shades of color to her own muffin. As she adds color, she begins singing.)

Vera: (Continues adding colors and sings along with Cherry.)

Both girls continue adding color to the different parts of their images, intermittently following each other's lead. Soon, their images begin to look similar. At one point, Cherry even "corrects" Vera when Vera selects a different color that Cherry didn't use. Cherry reaches over and taps the color onto Vera's screen, who resists and adds the color as she prefers. Cherry then looks at Vera's screen.

Cherry: Okay, so now…(pauses and looks back and forth between their screens, which are similar but not exactly the same as Vera's has two shades of green in her background) Um, why are you copying mine?

Vera: (Looks back and forth between the screens, murmurs something inaudible, hunches over, pushes her bottom lip out slightly and looks back at her own screen.)

Cherry: I don't want you to.

Vera: (Pauses, looks at her screen, back to Cherry's screen, and then reaches up to tap her home button) I'm getting out.

Cherry: (Looking back at her own screen and choosing more colors while humming.)

Vera: (Looks back at Cherry, crosses her arms, leans over to her own screen and looks at the menu of icon choices.)

Cherry: (Looks over at Vera's screen which is on the main iPad menu) You can copy me, but just not all the way.

Vera: (Picks up her stylus, squishes the tip repeatedly and looks at it. Looks back at Cherry's screen and then to her own again and taps open *Draw & Tell HD* again.) I'm playing something else.

The interchange continues as Cherry talks to Vera and points to her own drawings. Vera eventually re-opens the app and selects a coloring page of a fairy.

Cherry: Veraaa, I'm doing unicorn. You can keep doing that one.

Vera: Oh, unicorn. Um, can you do the same as me? (Points to her fairy picture)

Cherry: (Looking through her colors) Um, I'm gonna do first…

Vera: Do first that (points to Cherry's "unicorn" image and then back to her own image to add more colors). *(Both girls continued to add colors for several more minutes.)*

Throughout this incident, both girls were keeping an eye on the other's choices, and Cherry even helped Vera pick the same colors. But after too many similar choices (which she even helped elicit), Cherry decided the two pictures were too similar and that

Vera was "copying" her. When Vera stated that she would then play something different, Cherry modified her statement to suggest that Vera could "copy" but "not too much." In this instance, reflexive tracking occurred with both students, but for one student, too much similarity in play choices was openly resisted. However, the resistor didn't want the other student to play a different game and used several tactics to draw her back in, including modifying her resistance ("you can copy me, but just not all the way"), and later, approving of her tablemate's new choice ("ooh, that's a pretty one"), ignoring a retort, and exclaiming excitement about seeing her tablemate's image on the researcher's computer ("I can see yours, Vera!"). The girls soon found a balance of keeping an eye on each other's line-drawing color creations, but also maintained their independent creations. Later in the same sitting, Vera began another line drawing that was the same "unicorn" image Cherry was coloring. But the two verbalized several times their efforts to try similar color patterns while also maintaining some independence. Reflexive tracking in this instance led to a moment of resistance, but eventually became a means of maintaining a balance between shared and independent color-pattern creations.

To recap, reflexive tracking was a means by which students maintained a sideways glance on the screen, actions, and verbalizations of their tablemate and responded in some way to what they observed and/or heard. Reflexive tracking seemed to be a means by which students' social interactions were interconnected with their play choices. These findings extend the findings of Heft and Swaminathan (2002) who, examining children's social behaviors at the computer, described four types of acknowledging behaviors (observe/no reaction; observe/imitate/no comment; observe/comment/no imitation; observe/imitate/comment), a type of ignoring behavior (commenting and being ignored), conflict behaviors, and instances of sharing/helping behaviors. I also observed the behaviors these researchers described. However, while

Heft and Swaminathan (2002) sought to demonstrate how computers affected children's social interactions, my findings of reflexive tracking are meant to demonstrate how children's changeable play interests can be evidenced through examination of their own monitoring of play as well as the social behaviors and the actions they take as a result of these social interactions. It is not only how they respond (observe/comment/act) that is important to consider, but also how such actions are intricately connected to children's play interests, types of play, and even the means by which they engage in digital play. Importantly, the context of parallel-positioned and identically-prepared iPads seems crucial to the emergence of this phenomenon of reflexive tracking. It is possible that the phenomenon might not have emerged (or been noticed) within a different context.

SUMMARIZING FINDINGS AND CONNECTING TO RESEARCH QUESTIONS

1. In what ways do preschool children interact and engage with open-ended, symbolic-play related applications as indicated through their talk, actions, and interactions?

2. How does the classroom context seem related to the children's decisions, actions, and engagement with open-ended apps?

In response to research question number one: "In what ways do preschool children interact and engage with open-ended, symbolic-play related applications as indicated through their talk, actions, and interactions?" the data revealed that children engaged in three types of approaches—sampling, experimenting, and engaging in pretense—though they did so to varying degrees. Over the total 374 incidents, sampling was evidenced 32% (120 incidents), experimenting 67% (253 incidents), and engaging in pretense 5% (20 incidents) of the total incidents. (Note: the number of incidents as divided into the three types of play totals 393 because 19 of the 20 pretense play incidents also included experimenting-play codes. Thus, the percentage adds to over 100% due to double coding. See Figure 14.) Properties of sampling included: a relatively short amount of time engaged with a program, brief exploration of tools and/or gestures, and brief exploration of program content. Properties of experimenting included: a longer amount of time engaged with an app, extended use of tools and/or gestures, use of multiple tools and/or gestures; actions that indicated the student was experimenting with gesture, tools, and sometimes even creating designs. Properties of engaging in pretense included: student creation of an "as if" situation, and dialogue and/or sound effects (with another player or alone) indicating a play frame.

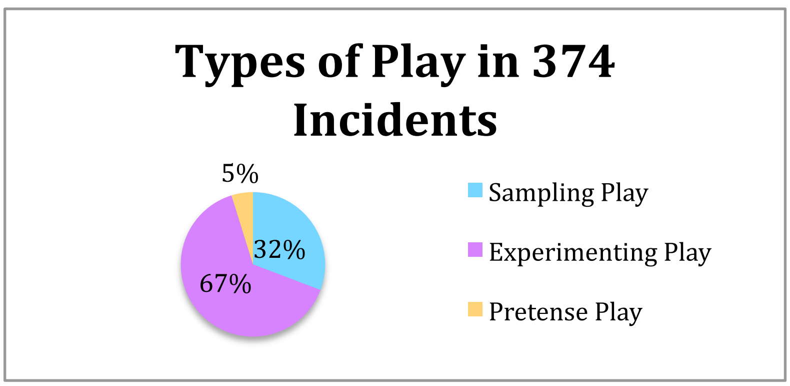


Figure 14. Types of Approaches Across 374 Total Incidents

Furthermore, students in this study engaged with the apps for differing amounts of time: of the 374 incidents reviewed in the current study, 44% lasted 60 seconds or less, 20% lasted 61-120 seconds, and 36% lasted 121 seconds or more (See Figure 15). Closer examination of shorter and longer periods of engagement revealed multiple possible influences on student engagement, including students' personal and social interests and curiosities, their level of interest in program content, their responses to technical difficulties, and their interactions with their tablemates. In addition, one particular behavior—labeled *reflexive tracking*—emerged as a common means of interaction that was often (though not always) connected with children's changing play interests. Properties of reflexive tracking include students' sideways glance and/or attentive ear toward their tablemate's activities, combined with their responsive action that often was connected with extending their current play interests or altering them in some way. Most often, reflexive tracking led to students following each other's app choice, tool use, gestural moves, or even design choices. Hence, reflexive tracking was determined to be another characteristic way children interacted with open-ended apps on a touch-screen device. This phenomenon of reflexive tracking was linked to students' intertwined personal and social interests.

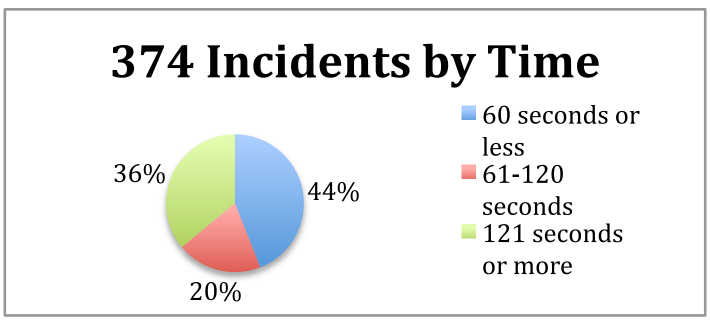


Figure 15. Percentage of Time Spent Across 374 Total Incidents

Finally, in response to research question number two, "How is the classroom context, related to the children's decisions, actions, and engagement," the data revealed that children's choices and actions were affected by multiple levels of contextual factors, including the classroom setting, the iPad station, and student's own personal and social interactions. The classroom context included the teacher's beliefs and actions that affected the classroom setting she organized (time and arrangement of student choice between new and recurrent hands-on, play-based learning activities), her expectations and rules for students (to learn academics and social skills, and have fun and love school), and the particular group of students she described as particularly socially cohesive. Within that setting was the particular context of the iPad station in which two identically prepared devices were placed alongside one another and students had up to 20 minutes per visit to engage with the available apps. The iPads included apps with varying content including drawing/painting, “block” and “magnet” and “stamp” construction, coloring, recording features, and fish and fluid manipulative play. Furthermore, students could select the tablemate they wanted to accompany them to the table (though respondents could refuse an invitation). Within this context students also were able to make their own choices related to their personal and/or social curiosities and their interests with regards to the available specific app content. Students also responded in various ways to technical difficulties and to the actions of their tablemate, as evidenced through reflexive tracking. Discussion on these findings and how they contribute to the existing field of play literature (particularly digital play) are shared in the next chapter.

Chapter 5: Discussion & Conclusion

"I'M JUST PLAYING iPAD": TOWARD A MODEL OF SOCIALLY SITUATED, DUAL-TABLET PLAY WITH OPEN-ENDED iPAD APPS

This study has reported the close observation of four- and five-year-olds engaging with open-ended symbolic play-related apps in a public pre-kindergarten classroom filled with opportunities for play-based learning. I examined students' play incidents (the timespan that includes all of a child's interactions with an app from the moment s/he chooses to enter an app until s/he chooses to enter another) across a 10-week study so as to gain insights into their choices and actions during digital play. Through constant comparative analysis of 374 incidents, I worked to describe and make meaning around students' socially situated, tablet play so as to extend existing findings on children's possible interests, choices, and engagement during school-based digital play opportunities (Escobedo, 1992, 1999; Genishi, 1988; Heft & Swaminathan, 2002; Labbo, 1996; Wohlwend, 2013). Using grounded theory methods (Glaser, 1978, 1992, 1998), I sought to add understandings of the particularities of digital play to the existing discourse on play as a socially-situated cultural phenomenon (Arnott, 2013; Eagle, 2012; Edwards, 2013; Ljung-Djärf, Åberg-Bengtsson, & Ottosson, 2005; Schousboe & Winther-Lindqvist, 2013; van Oers, 2013; Wang & Ching, 2013; Wohlwend, 2013).

Thus, to understand children's choices and interactions, I a) examined the ways in which children interacted with open-ended, symbolic-play related iPad apps; and b) observed the connections between the classroom context and children's digital play choices. The study focused on children's digital play in the classroom, and does not account for children's home-based digital play or previous out-of-school digital experiences (although parents were surveyed for home-centered practices). The findings extend the knowledge base on contextual influences on children's play by adding descriptions of how digital play occurred in one early childhood classroom (Arnott, 2013; Brooker & Siraj-Blactchford 2002; Ljung-Djärf, Åberg-Bengtsson, & Ottosson, 2005; Wang & Ching, 2003). It extends descriptions of the types of play associated with a technology tool (Brooker & Siraj-Blactchford 2002; Escobedo, 1992, 1999; Labbo, 1996; Wang & Ching, 2003) to include at least three play-based approaches children take: sampling, experimenting, and engaging in pretense. The findings also revealed multiple descriptions of the changeable nature of children's play (Øksnes, 2008; Reifel & Yeatman, 1993; Trawick-Smith, 2010; Wohlwend, 2013) within single incidents and across multiple incidents, allowing me to propose an explanation of children's play paths to include *reflexive tracking*—a means by which students gather ideas and try out actions when playing with apps alongside one another.

In my findings I described three approaches my participants took in their engagements and interactions with open-ended, symbolic-play related apps. Although I did not name these specific approaches as "play," I argue that the children themselves may have considered their actions (of whatever type of approach) to be play. As emphasized in my review of literature, children may engage in activities that researchers might not categorize as play, but that children do name as play. One such representative example occurred in my study during Week Three. In this incident, two students approached Juan, who was sitting at an iPad engaged with the app *ABC Magnetic Board* (2012). As he slid lollipop and mitten icons from the palette onto his screen, one student asked him to come to another center. The second student then asked him if he was almost finished. To these queries, Juan replied, "I'm gonna play there when I'm finished with iPad . . . I'm just playing iPad." As he made this statement he continued to select and slide icons, turning them, re-sizing them, and engaging with actions that other researchers (e.g., Escobedo, 1992; 1999; Fahndrich & Schneider, 1987) might have labeled as a form of exploration or manipulation rather than "play." Because he wasn't engaged in "transformation of objects for constructive purposes, or for the creation of an imaginary or pretend world" (Wohlwill cited in Escobedo, 1992), but instead manipulating and experimenting (Escobedo, 1992), and because he wasn't creating an image that evidenced the pictorial stage, researchers like Escobedo (1992, 1999) might have categorized his actions as "not play". But Juan himself labeled his actions as play. In the discussion that follows, I will argue that children's sampling, experimenting, and engaging in pretense were forms of play that were situated within a classroom context as organized and guided by the teacher, students' personal and social interests. I organized the findings into a grounded theory model of children's socially situated iPad play.

A MODEL OF SOCIALLY SITUATED IPAD PLAY

To construct a play model that considers not only the child's interests/choices, but also the sociocultural contexts surrounding these choices, I examined and analyzed children's interactions at the iPad station, comparing their interactions within a single incident, across incidents, and over multiple visits to the iPad station with different partners. As a result of my findings, I suggest that the ways children interact, the types of approaches they take, and their social interactions seem to be inextricably nested within the particular sociocultural setting in which these interactions are observed. Rather than explaining my findings against an existing theoretical lens, I attempted to stay open to capturing broadly the indicators of children's play interests, engagement, and play choices while simultaneously considering the social and cultural contextual situatedness of their interactions.

As expressed in the findings of this study and their demonstrations, the pre-kindergarten students in this study, when seated side-by-side at parallel, identically prepared iPads, supplied with open-ended apps, were observed engaging in three types of play outcomes: sampling, experimenting, and engaging in pretense. While these students did evidence examples of their own personal interests in the apps with which they chose to open and engage with, their actions also indicated the influence of the classroom context as organized by the teacher, and the often social nature of their sampling, experimenting, and pretense. Of particular note was the behavioral approach taken by all students during at least a portion of their iPad station experiences—that of "reflexive tracking." That is, in socially-arrayed digital play, students kept a sideways glance on their tablemate's actions and used information gained to guide their next choices. My model was developed from the data via grounded theory methods in an attempt to explain the interweaving of these multiple concepts and influences (see Figure 16). The model was developed from an initial review of 129 sample incidents; the remaining 374 total program incidents were then reviewed for fit with the model, as well as for instances which might indicate a need for slight adjustment to the model.

The model was developed as a means of incorporating all the findings in a way that demonstrated the interconnectedness of students' play, their personal and social interests, and the socio-cultural context in which all choices and actions were situated. The findings in this chapter have been organized into sections about the approaches, the social contexts, students' personal and social interests, and the social interactions connected to students' play choices. However, even though the findings were separated into these sections for the sake of explanation, to truly understand children's digital play with open-ended iPad apps the model illustrates how the separate parts interacted together. Furthermore, the parts of this model help illustrate how the findings addressed the research questions.

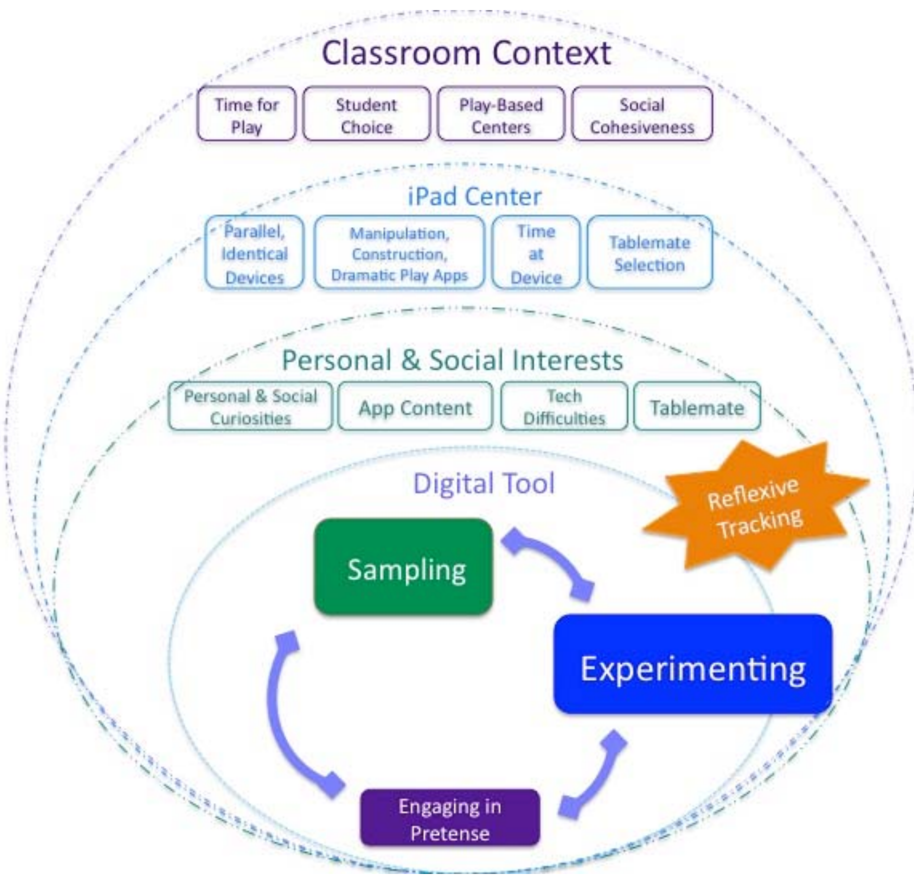


Figure 16. Model of Socially Situated Parallel Tablet Play with Open Ended iPad Apps

Accordingly, in this final chapter, I take the model and explain it from the outermost sphere of the classroom context to the innermost sphere of the digital play core. I begin with a section explaining the nested layers of contextual spheres within which my participants' choices and actions were situated, and include comparisons with existing literature. These spheres include the classroom-cultural sphere, the iPad activity-center sphere, the personal-social sphere, and the digital play core. I then explain where this research is situated within the field of play literature and discuss study limitations and implications for future research and for educators.

Contextual Spheres: The Sociocultural Situatedness of Digital Play

The model developed in this study indicates the four nested levels of sociocultural contexts children navigated in relation to their digital play: 1) the outermost cultural sphere of the classroom environment (as arranged by the teacher); 2) the iPad center (as arranged by the researcher); 3) the students' personal/social sphere (including students' personal interests, and influence of their classmates of varying interests, and experiences); and 4) the digital play core that includes specific approaches and social interactions. The following section moves from the outermost sphere (classroom) toward the innermost sphere (digital play core).

Cultural-Classroom Sphere

The findings of this study suggest that the choices and actions children take in their digital play seem to be supported (or constrained) by the available options allowed within their particular classroom-cultural context. Rogoff (1998) expresses the importance of considering an institutional-cultural plane when analyzing children's play, and many play studies have looked at macro-level cultural influences on children's play (e.g., Edwards, 2000; Fleer, Tonyan, Mantilla, & Rivalland, 2009; Pramling-Samuelsson & Fleer, 2009; Roopnarine, Lasker, Sacks, & Stores, 1998; Taylor, Rogers, Dodd, Kaneda, Nagasaki, Watanabe, & Goshiki, 2004; Taylor, Samuelsson, & Rogers, 2010; Tobin, Hsueh, Karasawa, & Mayumi, 2009; Tudge, 2008). This study, however, did not include data collection/examination of the larger external institutional-cultural forces, over which the teacher and children had little control, such as national, state, and district policy, state curriculum guidelines, or stakeholder influences. Therefore, rather than use Rogoff's term "institutional-cultural plane" which might suggest a reference to these larger external influences, I instead use the term "cultural-classroom sphere," while still working to maintain Rogoff's suggestion of examining an institutional-cultural plane surrounding children's play.

Even though the larger, macro-level structures were not examined through data collection and analysis, these influences were implicated by the teacher when she discussed her efforts to balance these external forces with her own beliefs and actions as she arranged her classroom and planned curricular activities. The study did, then, include findings on the more narrow field of the classroom environment. Play researchers have noted the unique play opportunities afforded by the particular cultural context of the classroom environment (see Reifel, Hoke, Pape & Wisneski, 2004), and the findings of this study offer additional descriptions of how this space can be connected with children's play interests and choices.

The cultural-classroom sphere was connected with the teacher's beliefs and actions as she arranged her curriculum and classroom in response to the external forces (noted above), and with her professional knowledge. This professional knowledge included her understandings of young children based on eighteen years of experience as an early childhood teacher, and her understandings of early childhood education discourse (e.g., developmentally appropriate practice and notions of play-based learning). The teacher in this study indicated her efforts to weave district and state expectations with her professional knowledge and beliefs. In the paragraphs that follow, I review the teacher's perceptions, actions, and attitudes toward the classroom environment and toward technologies, so as to discuss the connections between cultural-classroom contextual factors and children's classroom digital play experiences.

Teacher Perceptions and Actions Around the Classroom Environment

Situated within a school that offered teachers some freedom of choice in how they organized classroom curriculum to meet state and district expectations, Ms. Murray articulated her beliefs about the importance of children's play-based learning, socioemotional development, and technology-related play. She planned her curriculum and arranged her classroom environment to support these beliefs and to weave her professional knowledge and years of teaching experience with the mandated curricular expectations. She explained her focus of trying to balance a myriad of expectations and understandings:

> I do think we have to . . . keep up—you know we talk about developmentally appropriate all the time but I think we've got to keep up because those [pre-kindergarten] standards are changing. Ah, we've got to, in addition to doing hands-on things that their little muscles are able to do, we've got to fit in some ABC's here and there because things are just being pushed down. So we've gotta fit it all in! (Teacher Interview, December 2012)

Concerning play-based learning, Ms. Murray expressed her desire that her students would love school ["I think my number one goal is that they have got to love school… I want them to love school, and I want to slip some things by them that they don't even know they're learning." *Teacher Interview,* December 2012], and that play-based learning was a way to support children's learning through fun, hands-on, engaging activities. She also thought they should have some choice in those activities of interest to them. Accordingly, she arranged her classroom to include extensive amounts of time for children's exploration and experimentation. In addition to time, she provided a variety of materials for children to freely explore in multiple activity centers. These centers were arranged to offer many hands-on activities, student-selection, and materials that allowed for exploration and play in a variety of forms, including dramatic play, construction/building, math and science related activities, books, puzzles, puppets, art activities, and technology-related play. Ms. Murray also included teacher-led small group activities that were often related to classroom learning themes.

In addition, she believed students should develop not only academic skills but also socio-emotional skills. To support students' socioemotional development, she believed students should be encouraged to solve their own problems and learn to cooperate. As noted in an earlier Chapter 4 quote, Ms. Murray said: "And I want them to be, I want them to be good citizens, I want to send them off knowing how to solve problems, you know—things like that.". Ms. Murray often reminded students to try and work through their problems before coming to the teacher for help, and did not jump up to resolve student conflicts. Mrs. Murray did indicate that this particular group of students seemed to be more socially cohesive than some of her earlier groups of students. Even so, students still had occasions in which they had to work through problematic social interactions.

Ms. Murray also believed in the affordances of technology and the inclusion of technology play as one option of many in children's choices. She included technology-related learning as one of many important developing concepts for students, and included student access to classroom iPads, computers, and technology tools (e.g., overhead projector, electronic microscope) as well as dedicated time in the computer lab. She also noted that many of the students in this classroom also had access to technology outside of school—which was confirmed through parent surveys that acknowledged home access to other types of tablets and/or touch-screen cell phones. Finally, Ms. Murray indicated her openness to the idea of examining children's technology-related play so that she could learn more about it. This openness could also have been due in part to her own positive action-research experience within a university-sponsored classroom study on children's science learning. Other studies have described the connections between a teacher's understandings and perceptions of play and their practice (e.g., Bennett, Wood, & Rogers, 1997; Moon & Reifel, 2008). Studies continue to emerge on teachers' perceptions of digital play and the ways in which their classroom organization and practice might be connected to their perceptions (e.g., Ljung-Djärf, Åberg-Bengtsson, & Ottosson, 2005). The findings in the current study add additional description to the developing literature around the connections between teacher perceptions and classroom organization.

Teacher Attitude and Actions around Technology Play

The teacher in this study organized technology play opportunities as she did other center activities—as one of many choices that students could select at will, and wherein students were expected to work together and help one another as needed. Her beliefs and related organization for technology-related play align with the digital play as "available option" category explained by Ljung-Djärf, Åberg-Bengtsson, and Ottosson (2005). These authors offered three possible teacher attitudes and related environmental organization for digital play: 1) threat to other activities, 2) available option, or 3) essential activity. Features of the "available option" approach include teachers' beliefs and supports of children's engagement with technology according to their interests, adult support and encouragement of children's helping one another, and a perception of computer knowledge as shared knowledge. In Ms. Murray's classroom, students were able to choose whether or not to visit activity centers that included technology-related play (e.g., classroom iPad area, computers, or other technology-related play options) and they were allowed *and* encouraged to help one another. Such affordances allowed for shared knowledge around technology-related play around the classroom. The additional insertion, during the research study, of a second iPad area, organized with two identically prepared tablets and the presence of a researcher, may have offered students not only an "available option" but even an attractive one. Ljung-Djärf and her colleagues (2005) did not include "attractive options" as one of their categories, but neither did their digital play area include a similar type of organization as my study's iPad station.

In Ms. Murray's class, children were able to make choices about whether or not to visit the iPad station, and whether or not to engage all or only some of the available apps. Once at the station, seated iPad station players could play on individual devices and make choices about whether or not to help one another, or share knowledge with each other and with the researcher. Interested onlookers were encouraged to find another center so as to allow seated players opportunity to make their own individual choices. Perhaps because this additional center offered a *new* context in this particular classroom: additional iPads identically prepared and placed parallel, including *new apps*, and with a *interested* person seated at the table with additional technology equipment (computer, video camera, speaker), it may become more than an "available option." While the introduction of new activities was common in this particular classroom, the additional contextual features presented in the research iPad activity center may have raised the profile of the activity to become an attractive option.

These multiple elements of the classroom environment—the teacher's beliefs and actions, her organization of the environment, and her attitudes toward technology-based play—seem to be important aspects of the classroom-cultural sphere within which study participants' digital play experiences were situated. This teacher's beliefs and actions seem connected to her arrangement of a particular classroom environment in which time, materials, student choice, opportunities for exploration and play were important contextual elements. In this space, digital play was one of many options, and an additional option of a specially organized iPad station was included.

Connections Between Classroom Culture and Children's Play Actions

When trying to make meaning of students' digital play choices and social interactions, inclusion of the cultural-classroom context seems important because it offers opportunity to consider how a particular setting might be more or less supportive of children's choice making, actions, and social interactions. As noted by Reifel and Yeatman (1993), complex descriptions of classroom play should include consideration of many possible influences, including "materials, social relations, real-world experience, play decisions, and time" (p. 355). Furthermore, these elements are situated within a specific classroom environment. As noted by Moon and Reifel (2008), classroom play opportunities can be influenced by teacher beliefs and their arrangement of the environment. Much like the teacher in Moon and Reifel's (2008) study, Ms. Murray also valued and arranged her classroom to support "concrete, manipulative, fun, hands-on, and creative activities" (p. 62). In the current study, children's choices were situated within this layered classroom cultural context, and therefore the types of digital play and social interactions that emerged at the iPad station may have occurred, in part, because of the opportunities afforded by her particular classroom context.

Much of the recent existing research on young children's digital play experiences has centered around home-based play (Davidson, 2010; Eagle, 2012; Marsh, 2010; McPake, Plowman, & Stephen, 2010; O'Mara & Laidlaw, 2011; Stephen, McPake, Plowman, & Berch-Heyman, 2008; Takeuchi, 2012) or school play that occurred outside of a traditional classroom context, such as an after-school club (Wohlwend, Vander Zanden, Husbye, & Kuby, 2010). However, such studies offer different contextual features than classroom-based play. Of the studies that have examined children's digital play in classrooms, the types of play explained and social interactions did not include consideration of how children's choices and actions might arise in relation to multiple spheres of contextual influence. Instead, such studies looked either at individual children (Escobedo, 1992, 1999; Labbo, 1996) or at social interactions in groups around single computers (Arnott, 2013; Brooker & Siraj-Blatchford, 2002; Ljung-Djärf, 2008), or parallel computers that were differently prepared with few open-ended apps (Heft & Swaminathan, 2002; Wang & Ching, 2003). It seems important, however, to consider the multiple layers of sociocultural context—particularly the classroom context in which children's choices were situated. Schousboe & Winther-Lindqvist (2013) highlight this importance of sociocultural context surrounding children's play:

> [T]he individual development of human beings occurs while and because they participate in social communities and that these communities are influenced by the particular cultural and historical contexts in which they are embedded. This makes it obvious to equally regard human play as an activity influenced by the communities in which it occurs and to try to understand these communities, both as they occur here and now and in their temporal and social anchoring (p. 4).

I infer from this perspective that such a consideration of players' choices as situated within a particular social and historical context might offer new insights because play actions can be considered in light of their in-the-moment situatedness and their place within the larger historical and social setting. Thus, in addition to rich understandings that arise from consideration of children's play/play texts through varying theoretical lenses (Frost, Wortham, & Reifel, 2012; Reifel, Hoke, Pape, Wisneski, 2004; Sutton-Smith, 1995), the foregrounding of multiple contextual planes (Rogoff, 1998) might allow us to consider children's choices as play as it occurs *in situ* for children. Edwards (2013) suggests that a contextual perspective of play—and in particular, digital play—might allow us to better understand how children use and make meaning in their play for their own purposes and interests:

> Wood (2010) argues that a contextual perspective on play means understanding play in relation to how it operates for young children in terms of cultural

> meaning-making and participation in social relationships. From a digital play perspective, context also matters because it enables technologies to be located in the social setting in which they are encountered by young children (Waller, 2010), rather than considered as singular artefacts that produce types of play that may or may not look like traditional play (p. 201).

As later discussed in the section on the innermost contextual sphere—the digital play core—students engaged in actions that I organized into three play-based approaches (sampling, experimenting, engaging in pretense). However, these types of play approaches connected with open-ended iPad apps were situated within a particular sociocultural context. The types of play and social interactions that emerged suggest salient play interests of children in a particular time and space, as well as how these interests changed in dynamic relation to the multiple contextual spheres. The cultural-classroom sphere of the classroom is but one plane of context. Within this classroom, I organized a particular activity center—the iPad activity center.

iPad Activity-Center Sphere

Nested within the particular classroom context was the additional context of the iPad station itself, in which students could choose to visit with a selected partner and interact with parallel and identically prepared iPads, pre-set with specific open-ended iPad apps. An organization of the iPad activity center that included two identically prepared devices with ten open-ended apps offered certain contextual affordances different from earlier research on children's technology play. Findings in the current study suggest that the organization of the computer area might indeed be an important contextual factor related to students' play interests and actions. In this subsection, I discuss how the organization of the center, the variety of program options, and the variability within the available programs were important contextual features in which children's digital play choices were situated.

In the current study, the center was organized with several key elements: two identically prepared iPads placed alongside one another on a table, and situated in the presence of an adult (the researcher) who also had additional equipment (camera, computer, speaker) as well as two center-management devices (a student-created waiting list and a timer). The presence of two identically prepared iPads offered students the ability to engage in solitary play with their desired app, or some form of following or joint play with a tablemate. That the devices were in close proximity and identically prepared offered the possibility of fluid movement between individual and social interests—students could explore programs on their own while easily keeping an eye on the actions of their tablemate. Varying forms of joint play on individual devices has thus far been discussed in regards to online gaming (e.g., Wohlwend, Vander Zanden, Huysbe, & Kuby, 2010), and early studies of children engaged with simple programming games (Genishi, 1988; Genishi & Strand 1990). The current study indicates that children's social interactions in digital play was also possible with offline, open-ended, tablet apps in part because of the iPad center organization and device preparation. Furthermore, players seated at their own devices did not evidence vying for turns or the sorts of power negotiations witnessed in earlier studies of groups of children gathered around two differently prepared computers (Wang & Ching, 2003). Nor did players seem to engage in more overt positions and positioning as did groups of students amassed around single computers in the preschool classrooms observed by Ljung-Därf (2008).

Furthermore, additional elements such as researcher presence, a researcher-maintained waiting list, and the discouragement of onlookers, may also have prohibited observations of previously documented findings around power negotiations and positioning (Arnott, 2013; Ljung-Därf 2008; Wang & Ching, 2003). The very presence of the researcher at the table, as well as the student-suggested researcher-maintained waiting list, may have curbed power negotiations and positioning that might have occurred in the absence of an adult. In addition, the discouragement of onlookers may also have hindered observation of student power struggles and positioning found in earlier studies. While power struggles and positioning may have been avoided, the lack of onlookers seems also to have prohibited observation of group play around computers (Arnott, 2013; Ljung-Därf, 2008; Wang & Ching, 2003) as well as student collaboration/scaffolding of one another—findings noted by earlier researchers examining students' play and collaboration around single computers in multiple preschool classrooms (Brooker & Siraj-Blatchford, 2002). These differing contextual factors may have contributed to a lack of alignment with earlier findings on children's technological positions, social status roles, and group play (Arnott, 2013; Brooker & Siraj-Blatchford, 2002; Ljung-Därf, 2008; Wang & Ching, 2003). It seems the preparation and placement of the devices, the rules of the center (two players only and discouragement of onlookers), and even the presence of the researcher (who also maintained the waiting list) may have promoted certain play opportunities and social interactions while constraining others. The differences in play opportunities and resultant findings may have occurred in part because of the differing technology-activity-center contexts.

When compared with a study that included more similar contextual variables, my participants' actions evidenced more alignment with earlier findings of students' social interactions in their digital play. In a study of an early childhood classroom with a similar activity-center context, Heft and Swaminathan (2002) evidenced similar findings of students' social interactions in their digital play. During free-choice center time at a preschool in which two identically-prepared computers were placed side by side, Heft and Swaminathan (2002) described six types of computer-centered social interactions that occurred in the current study: 1) observing and not reacting; 2) observing and imitating with comment; 3) observing and imitating without comment; 4) observing and commenting without imitating; 5) commenting and being ignored; 6) sharing and being helpful. Although Heft and Swaminathan also examined gender variations, they did not look closely at how students interacted with partners over time (in one sitting and across multiple visits), nor how student choice of tablemate might be connected with the types of interactions observed. In my study, I examined students' play paths not only for whether students duplicated each other's actions and commented (or not), but also for how their ideas and play unfolded over time within a single incident and across multiple incidents and partners. This examination allowed for an extension of the social interactions described by Heft and Swaminathan to also include the ways in which these social interactions unfolded over time and revealed children's changeable play interests and actions as they occurred at the uniquely arranged iPad station. Analysis of these changeable interests as demonstrated through these socially situated play paths allowed me to develop the concept of reflexive tracking (discussed in greater detail below). However, this concept might not have developed had I not had opportunity to follow children's actions and verbalizations as they sat alongside chosen tablemates at identically prepared devices.

In addition to the activity center arrangement of device positioning and specific social setting, the iPads themselves were fitted with specific apps that offered certain possibilities and affordances while hindering others. Unlike studies of children's computer or tablet play that focused on gaming programs (specific task-related games with accompanying on-screen "reward," e.g., Lynch & Redpath, 2012; Stephen, McPake, Plowman, & Berch-Heyman, 2008; Wang & Ching, 2003)—this study focused on multiple open-ended apps with varying opportunities for different types of play. A few studies have examined singular open-ended programs such as drawing programs (Escobedo, 1992, 1999; Labbo, 1996), or programs that included several open-ended exploration opportunities such as "scene creation games, free painting . . . and face making" (Heft & Swaminathan, 2002, p. 165). The current study, however, offered ten open-ended apps, with opportunities for different types of play, including manipulative, construction, and pretense-related play. The presence of these apps allowed the tracking of students' varying actions and social interactions when offered several pre-selected choices. Although students had a variety of choices among the ten research-related apps, gaming apps were not included, and thus students were constricted in their choices to play *any* way they chose. Indeed, the pre-selected apps may not have been of interest to some students. The resulting types of play and social interactions that occurred in the inner-most digital core sphere in this study must be considered in light of not only the classroom context and the iPad activity center organization, but also as connected to the selected apps available to children engaged at this iPad center.

To add yet another layer to the iPad center contextual sphere that included devices prepared with ten programs of varying content, the apps also differed in their offerings of tool options, presence/amount of text, and icon images (e.g., diverse representations of common tools such as an eraser or a drawing implement). Some apps included many template-type objects (e.g., stamps, magnets, line drawings) and backgrounds, while others included limited amounts of template-type objects. A few apps provided more constrained play opportunities—such as *ABC Magnetic Board* (2012), wherein students' only choice was to design an image using a large variety of moveable/resizable clip-art magnets on several background choices. Other apps offered multiple play opportunities, such as *Draw & Tell HD* (2012), which included coloring pages, free-drawing opportunities, clip-art arrangement, and recording of movable clip art with voiceover.

These different types of apps seemed to afford opportunities for exploring, experimenting, creating, and engaging in pretense while constraining opportunities to engage in "gaming" activities (though several students created their own games such as "scaring fish" or "covering all" stamps with other stamps). This inclusion of ten apps allowed for analysis of how students moved (or not) through many choices, as well as their varying (or not) interests over time, and the ways in which they gathered ideas from one another. Furthermore, examination of children's choices across multiple apps provided a space for theorizing about types of play that might occur across several different types of programs rather than in response to single computer programs, such as those described by Escobedo (1992; 1999) and Labbo (1996).

Therefore, I argue that the very organization of the iPad station—device preparation and positioning, center organization (including the presence of the researcher, discouragement of onlookers, student-selected tablemates, researcher-maintained waiting lists), and multiple available programs with varying content and tools were all center-based contextual features that seem intricately tied with students' play choices and actions and the phenomenon of reflexive tracking. Students' choices to sample, experiment, or engage in pretense during iPad play were situated within this context and their actions seemed to reveal connections with their personal interests, their emerging understanding of the programs, and the influence of multiple social factors, including their tablemate, the iPad station, and the classroom setting.

Personal/Social Sphere

Thus far, I have noted the multiple nested levels of context within which children's play choices and actions were situated: the classroom, the iPad station arrangement, and the available iPad apps. However, it is the third nested level—the personal and social sphere—that seems to reveal the complexity of children's choices and how contextual factors seem to be connected with, but not necessarily predictive of, children's actions. This third sphere includes students' own personal and social interests and varying purposes in response to the available apps, as well as their interests in interacting with (or not) a tablemate they selected (or by whom they were selected). In this section, I contend that while the sociocultural classroom context seemed to be the sphere in which all student action occurred, there was still interplay between the person (individual interests and personal funds of knowledge) and the situation (classroom context) (Ross & Nisbett, 2011). Based on the findings displayed in this study, I suggest that students' choices were situated within multiple contextual levels, but still evidenced children's agency in their pursuit of their personal interests. In the next section I discuss several examples of students' active and dynamic choices as situated within the previously described contextual spheres, including their choices within the classroom context, at the iPad station with specific iPad apps, and the ways in which they moved between personal/social interests.

Active Choices within the Classroom Context

Students evidenced some level of agency within the classroom context as they made decisions whether or not to visit the iPad station. The classroom was arranged to include time, free choice, and multiple activity centers for play. With regard to digital play, students in this study had access to classroom computers, a classroom iPad area, and the research-based iPad activity center. Tracking of students' visits to the iPad station in particular revealed that, given the opportunity to engage with open-ended iPad apps, most children did choose to visit the center. Indeed, the option might have even been an attractive one for students. However, the context that afforded availability of digital play at the iPad activity center did not *automatically* result in a child's choice to engage in it. Nor did students' previous iPad experiences act as a predictor of their interests in visiting the iPad station. Tony—a player with both home and school experience playing iPad apps—visited the iPad station several times, yet there were instances in which he declined an invitation to the iPad station, and others in which he left the iPad center early when his play interests shifted to non-digital play. Tony showed excitement when engaging with multiple iPad apps, especially when he could engage with "show recording" apps. But he had other non-digital play interests as well, and chose to visit other play areas (e.g., art area, block area, dramatic play area) of interest to him.

Tony's example indicates that even when students are situated within a context offering multiple digital play choices, they may choose not to engage in any of them. Although this finding occurred within a school setting, it aligns with the findings of children's home-based technology play by McPake, Plowman, and Stephen (2010), in which a child might choose *not* to engage in technology-related play even as an inhabitant of a "technology-rich" home filled with enthusiastic technology users. McPake and her colleagues suggest the importance of recognizing "that even young children have agency in this context, and are not simply the artifact of their families' financial circumstances and their parents' experiences and attitudes" (p. 17). Whether the larger contextual sphere is positioned within a classroom or a home, the availability of and support for digital play may not predict children's desires or interests to engage in digital play. Thus, while it seems important to understand children's digital play choices as situated within the larger contextual sphere of classroom context, it is simultaneously important to consider the possibility that even if digital play opportunities are made available, children may still choose *not* to engage in digital play, or may not find the available digital play options to be of interest.

Active Choices at the iPad Station & With Available Apps

When students did choose to engage in digital play at the iPad station, their choices were both afforded and constrained by the iPad center arrangement and the available apps. Concerning the center arrangement, identically prepared devices placed alongside one another allowed students the opportunity to engage with apps individually or to interact with a tablemate as apps were explored "together," even though on separate devices. Concerning the available apps, students' actions within and across programs suggested that they were both free to select apps and make their own meanings with available tools, but also were constrained in that they could not make *any* choice they wanted to make.

My examination of each child's app engagement across five weeks of the study indicated how children's digital play choices revealed their own unique interests. Some students opened and engaged with every available app across the study (e.g., Maya, Topher) while others opened and interacted with only a few apps (e.g., Tony, Will). Some students engaged in playing to sample during the first weeks of the study (e.g., Maya, Cherry) while others did so in the final weeks (e.g, Beth, Marie). Some students revisited the same app multiple times and engaged for lengthy periods of time (e.g., Beth's multiple and lengthy engagements with *ABC Magnetic Board* (2012), or Cherry's multiple and lengthy engagements with *Draw & Tell HD*, 2012) while others revisited the same app for short periods of time (e.g., Simone's repeated engagements with *Fluidity* [2011]). Furthermore, just because an app offered certain possibilities—such as a show recording option, or multiple tool options—the programs' possibilities were not predictive of what students might choose to do with it. For example, Cherry revisited *Draw & Tell HD* (2012) five times across the study, and spent the majority of all her iPad station time engaging with this app. However, even though this app offered several different play options—coloring pages, free-drawing opportunities, clip-art arrangement, and recording of movable clip art with voiceover—Cherry only engaged with the coloring pages (and added clip-art features only for a few moments during one visit) across her 52 minutes of interactions with this app throughout the study. This was her chosen mode of interaction even though she had been exposed to the other program options. Cherry engaged this app in the ways that were most meaningful to her, and her choices indicated that even with many options, she took actions that revealed her unique play interests.

That students might have some agency to take up digital play in ways of most interest to them aligns with the findings of Arnott (2013) that a device and available options were not determinants of children's actions, but could only provide opportunities for interactions. Arnott asserted that in her own study, "…it appeared that technologies afforded certain opportunities but it was how children acted in light of these opportunities that resulted in the interactions observed" (p. 111). I concur with this assertion, based on my interpretation of the findings, which seemed to suggest that the center arrangement and available app options offered certain possibilities but did not dictate children's responses. Children still evidenced some agency to engage in play according to their interests, and to take actions that were meaningful to them in a particular space and time.

However, even with ability to make their own play choices with the given apps, students' freedoms were constrained in some ways so that they were unable to make *any* choice they wished. For example, not every program they might want to play was included (as noted by students who looked for certain apps they knew from home, or for apps that were removed after program malfunctions, such as *Sock Puppets* (2012), which was removed after Week One). Furthermore, while they could choose from any of the tools available in a given program, each app allowed only a finite number of tools, with limitations on how the tools could be used. As found by other researchers (Marsh, 2010; Wohlwend, Vander Zanden, Husbye, & Kuby, 2010), children's choices were sometimes thwarted by the game construction; students could not do *any*thing they wanted, but were constrained by the tools and program affordances.

Moving Between Personal or Social Interests and Using Reflexive Tracking

As students constructed their own meanings within the available apps, they also made choices that suggested movement across a spectrum of independent to social interactions. The findings in this study align with earlier research that suggests students make choices according to their personal interests (Labbo, 1996; O'Mara & Laidlaw, 2011; Stephen, McPake, Plowman, & Berch-Heyman, 2008) and social interests (Genishi, 1988; Labbo, 1996). In addition, this study extends these earlier findings by describing children's changeable play interests (Reifel & Yeatman, 1993) across the spectrum of solitary to social play (Parten, 1933), and contributes the concept of "reflexive tracking" as a means by which children navigate their dynamic play interests.

Comparisons of students' choices and actions revealed the meandering paths their play took within and across iPad station visits. Students fluidly moved through multiple approaches of sampling, experimenting, and engaging in pretense. They spent varying amounts of time with multiple apps, and attended to the actions of their tablemates with changeable levels of social engagement. Furthermore, children took up numerous actions for varying purposes when engaged in exploring, experimenting, creating, and pretending through digital tablet-based play. The findings shared in this study add additional descriptions to existing studies on children's movement through multiple types of play with varying levels of engagement (e.g., Labbo, 1996; Reifel & Yeatman, 1993).

Additionally, it seems that students' fluid movement through different types of play and with varied levels of social engagement occurred in connection with their interests (personal and social) and the sociocultural context rather than due to progression through a developmental hierarchy. This is a different perspective than that of traditional play literature that suggests play choices and actions are driven by developmental progression (e.g., Piaget, 1962, 1976). Labbo (1996) found similar patterns of children's changeable interests and actions in their computer interactions, explaining, "children did not master one level (e.g., playing), then progress to another level (e.g., writing); rather, children shifted among the stances and the symbolic modes according to their own individual intentions" (Labbo, 1996, p. 364). My findings also revealed children's continuous shifts—within a single session and across the entire study—through multiple types of play and varying levels of social interaction. These findings on the dynamic nature of children' play choices seems to echo Reifel and Yeatman's (1993) discussion of multiple influences on play, including: "materials, social relations, real-world experience, play decisions, and time" (p. 355). The model developed in this study suggests that in addition to these elements, several nested sociocultural contexts are also possibly connected to children's dynamic and changeable play choices.

In the current study, the combination of the iPad station contextual sphere—with identically prepared parallel devices, and the social feature of calling over a tablemate of one's choosing—seemed to make a space for children to move between independent and social interests in their play choices. Analysis of children's play paths—individually and in relation to those of their tablemate—allowed me to develop the concept of *reflexive tracking* as one possible means by which students might gather ideas for their evolving play choices. The concept seems to align with Reifel and Yeatman's (1993) assertion that "Ideas can lead to one another or build on one another" (p. 361), and notes potential significance on this characteristic of children's play. Furthermore, I inspect a new setting and describe in detail the ways students in this study gathered and built upon each others' ideas in digital play. Properties of reflexive tracking include students' sideways glance and/or attentive ear toward their tablemate's activities, combined with their responsive action that led to further sampling, experimenting, or pretense play. Most often, reflexive tracking led to students following each other's app selection, tool use, gestural moves, or even design choices. Hence, I suggest that reflexive tracking is one possible way the students in this study chose to interact with open-ended apps on a touch-screen device, and it seems to indicate their intertwined personal and social interests.

Unlike earlier work that focused on social interactions that indicated students' computer control and navigation proficiency (Freeman & Somerindyke, 2001), or the types of children's talk/interaction around parallel computers (Heft & Swaminathan, 2002) my concept of reflexive tracking suggests the interconnected paths of attention and action. Students' seeming ability to maintain a sideways glance at the actions of their tablemates and take up the actions of interest to them may hint at the possibility of simultaneous attention that earlier research has attributed to specific community-cultural differences (Mexican heritage and European-American heritage) and maternal education differences (Correa-Chávez, Rogoff, & Mejía Arauz, 2005). Correa-Chávez et al defined simultaneous attention as a means by which a child:

> skillfully attended to two or more events with no pause or interruption in the flow of one activity for the sake of the other. Both activities were carried out at the same time, with each line of attention maintained as continuously as if there were no other focus (p. 6).

However, the students in the current study spent periods of time in which they seemed to be engaged in reflexive tracking, even with differing community-cultural experiences (attending the same school, but with varying cultural backgrounds—see Table 5, Demographics Table in Chapter 4) than the participants in the study by Correa-Chávez, Rogoff, & Mejía Arauz (2005). Although reflexive tracking may have been linked to a student's change *or* continuance in action (see *Reflexive Tracking* section in Chapter 4), I suggest the concept of reflexive tracking is a possible element that could contribute, in some instances, to what Correa-Chávez and her colleagues call "simultaneous attention." While this finding does not negate Correa-Chávez et al's findings about community-based cultural influences as connected to simultaneous attention, it does suggest that there might be additional contextual factors besides a particular community-cultural background alone that could set the stage for children's varying observational monitoring. I argue my findings suggest that classroom context, the arrangement of devices, and the opportunity for digital play seemed to provide affordances for students to engage in "simultaneous attention." Students in this study took up digital-play in a setting where social interaction and helpfulness among students was encouraged. In addition, identically prepared parallel iPads offered multiple opportunities for students to visually observe one another. Furthermore, the arrangement whereby students could invite another child to the center offered yet another factor that might be connected to students' interests to engage with an app while simultaneously monitoring the actions of their tablemate.

Although eschewing the social influences and interests on play choices, other researchers have noted children's continuous shifting in thinking and play choices in their non-digital play. Øksnes (2008) cited findings that suggest children's "meaning and content of play and leisure might change along the way" (p. 154). Øksnes interviewed children who responded that playful and non-playful activities shifted according to one's feelings in the moment of whether or not something seemed fun (see Øksnes, 2008, p. 159). Such interviews with children give them a voice in indicating their understanding of the dynamic and changeable nature of play. Although my own young participants did not verbalize such feelings, their varying play choices within and across incidents—as evidenced through reflexive tracking—seem to align with this possibility. Thus, reflexive tracking, in the specific situated context of my participants' digital play actions, may be a means by which children keep a form of attention toward other possible "fun" choices or even follow their feelings in a particular moment. This is yet another hint that children's play choices and actions might be indicators of their meaning-making and social interests in a particular moment.

Digital Play Core: Sampling, Experimenting, & Engaging in Pretense Within Contextual Spheres

At the center of this study's grounded theory model of socially situated digital play with open-ended apps is the digital play core. Within this innermost sphere, I describe the types of approaches into which I categorized children's digital play actions as they engaged with the given iPad apps in this particular classroom context. I examined play incidents (all actions from a child's app opening to closing), coded actions, and collapsed the codes into three overarching categories: sampling, experimenting, and engaging in pretense. I then examined how often children engaged in each of these types of play. Over the total 374 incidents, children played to experiment twice as often (67%) as they played to sample (32%), with overt examples of pretense-related play emerging in very limited amounts (5%). These findings of different foci in play extend earlier findings of researchers who also noted exploratory, experimenting, and creating phases in children's digital play (see Couse & Chen, 2010; Escobedo, 1992, 1999).

Before discussing each of the three categories of student approaches, it is important to express that these categories are not intended to indicate a hierarchy of play types. Although earlier studies organized such approaches into hierarchies toward "low" and "high" level play (e.g., Couse & Chen, 2010) or non-play and play (Bhargava & Escobedo, 1997; Escobedo 1992, 1999; Labbo, 1996), I have not arranged my categories into a hierarchy with descriptors of "high" and "low" tablet use. Instead, I suggest that students moved through these different play outcomes as a manifestation of a spectrum of interests both individual and social in nature, and in response to different app affordances, tablemates' actions, and students' developing familiarity with available tools and gestures. I assert that children's sampling, experimenting, creating, and pretense related approaches indicate not levels of tablet use, but rather a variety of playful ways that children came to understand and engage with apps of interest to them, and do so within a rich context of social (school, classroom, teacher, other students) influences. In light of this claim, I discuss in the remainder of this section the digital play core described in my model of socially situated dual tablet play, and how these play types compare with existing types of play that have been described in other digital play research.

Sampling, Experimenting, and Engaging in Pretense: Three Types of Play

Sampling Play. I describe properties of the "sampling" play category to include a child's relatively short amount of time engaged with a program, his or her brief exploration of tools and/or gestures, and his or her actions indicating s/he is determining an app's content without becoming engrossed in creation or design. This extends earlier research that defined a category of tablet play as "exploring and experimenting," in which students clicked/tapped on a particular option to "see what will happen" (Couse & Chen, 2010, p. 87). I expand on that explanation by indicating that a specific type of exploration includes the "sampling" of a program, through which not only tools, but also program content and even gestures, can be explored briefly before a player switches to a different app. For example, Juan and Wayne engaged for a 20-second interaction with *Scribble Press* (2012). In their brief sampling of this program, Juan examined the program content by: opening the same app as Wayne, glancing at Wayne's book options, suggesting and selecting a specific image on Wayne's tablet, returning his gaze to his own tablet images, and after brief examination, closing the program. As he closed the program he implored Wayne to do the same, saying,

> "Get out!" [The pop-up disappeared and Juan scrolls through his "shelves," looking at the different set of book covers.] "These are just books. Get out [he taps his iPad home button]. These are just book, Wayne!"

After a brief exploration of the program content, Juan's actions and verbalization suggest that the "just books" content was not an option in which he was interested. Juan sampled the program and then moved on to look for other options, encouraging his tablemate to move on to other possibilities as well.

Experimenting Play. My second category of "experimenting" included the following properties: a child's longer amount of time engaged with an app, children's actions that indicate s/he is experimenting with single or multiple gestures, tools, and sometimes even the creation of designs. This category is similar to a combination of two categories enumerated by Couse and Chen (2010): "investigate" and "create". The authors of this study defined the "investigate" level to include instances in which a "child tries to figure out how to use the tablet to create a desired effect," while the "create" level included instances in which a child "produces desired effects in drawing even if the drawing is not a realistic representation…the child is content with, and is clear about what is being drawn" (p. 87). In my study, children evidenced similar investigation and creation approaches, although I combined the two categories into one and used the word "experiment" rather than "investigate," because the distinctions between investigation and creation seemed to overlap and blur. The term "experimenting" seemed to allow for fluid movement through students' investigations and creations. Constant comparison of the data across multiple students and apps revealed additional features of children's experimenting, including their testing and practicing with tools and gestural moves, and creating compositions. Children's testing (akin to Couse and Chen's "investigating") included the sorting of media, deciphering of icons, and uncovering tool capabilities—actions that were facilitated by students' curiosity, social input (from the researcher or their tablemate), and sometimes even by serendipitous stumblings into new information. Practicing involved sustained, repetitious use of single or multiple media, tools, or gestural moves, and sometimes led to a creation mode, in which they created non-representational or representational compositions. In addition to including additional features of students' experimenting approaches, I also found the stylistic differences—less ordered versus more methodical—in the ways students engaged in experimentation. Finally, although Couse and Chen indicate that the "create" level of tablet indicated children's goal of producing "a desired effect in drawing" (p. 87), in the current examination I extend these findings by noting that students demonstrated instances in which they created a complete image for its own sake, or, on occasion, to create a backdrop for facilitating game play. I also explain differences between exploring and experimenting by suggesting that playing to experiment included more sustained testing and practice with media, tools, and gestural moves, and manipulative play for the sake of testing, practicing, and creating. For example, in Lela's methodical testing of adding color with the crayon tool in *Draw & Tell HD* (2012), she methodically moved, one-by-one, from left to right through many of the available color choices by selecting a crayon, swiping her finger several times across the screen to add color to "paper" and then moving to the next adjacent crayon (See Table 9 in Chapter 4). Or recall Glenn's practice with multiple gestural moves in *Pocket Pond* (2012) (See Figure 6 in Chapter 4). In addition, recall Vera's and Marie's movement between representational and non-representational images created in *Pattern Blocks* (2012) (see Figures 7 and 8 in Chapter 4).

In addition to extending the findings of Couse and Chen (2010), my "experimenting" category also adds nuance to the findings of Labbo (1996), who includes program exploration of tools, icons, and actions in her "screen as landscape" stance and argues that during this time, students "explored the landscape of screenland through repeated individual and collaborative exploratory activities, [and] they learned action schemes that they generalized into dependable procedures or routines to follow when they took other stances toward screenland" (p. 366). Analysis of student incidents in my own study suggested children's sampling and experimenting might be connected with other goals than merely learning "action schemes" and "dependable procedures or routines to follow" when engaging in "other stances"—although such procedure acquisition was surely a part of their actions. For example, in addition to learning how to use the program or to engage in pre-object play as noted by Labbo, the students in this study seemed to be also simultaneously sorting out their interests and curiosities as individuals and within the social environment toward the multiple play opportunities. They were, through their playing to sample and later experiment, sorting out not only "how does this work" and "how can I use it" but also exploring whether certain tools, gestures, icons, and app capabilities were interesting and fun to them (e.g., Juan's disinterest in "just books," or Simone doing "magic" with *Fluidity* (2011) while commenting, "I'm having so fun!!").

Pretense-Related Play. Finally, my "engaging in pretense" category included the following properties: student creation of an "as if" situation; dialogue and/or sound effects (with another player or alone) indicating a play frame for pretense. Recall Wayne and Juan scaring fish in *Pocket Pond* (2012), or Glenn fighting as Spiderman while engaged with *Fluidity* (2011), or Cherry and Tony enacting characters in *Sock Puppets* (2012). This category can be connected to the findings of Escobedo (1992; 1999) and Bhargava and Escobedo (1997) who viewed this type of activity as the true example of "meaningful play," while considering "exploration" and "manipulation" non-play (Escobedo, 1999, p. 107). These authors suggest that "meaningful play behaviors" are those associated with construction of objects and fantasy. My model suggests that pretense related play is but one type of digital play, and that exploration and manipulation are also forms of digital play in which children might engage. I assert that the construction of objects and fantasy are not the only examples of "meaningful play," and that the other two types of play—sampling and experimenting—were equally valid forms of play. Furthermore, students' movement between and across these three types of play was fluid and reflexive tracking indicated the changeable nature of such movement—thus my model's inclusion of bi-directional arrows between the types of play with reflexive tracking featured throughout the personal/social sphere and the iPad station sphere.

Further Comparisons with Existing "Types" of Digital Play

In addition to the extensions of and differences with existing digital play research discussed thus far, my three digital play categories also differ from other computer-based research that has separated play into its own category as distinct from creating and writing (Labbo, 1996). Labbo (1996) organized children's digital experiences with a computer drawing program to include stances that indicated playing, creating art, or writing. The play category included three stances: screen as landscape (for exploring and experimenting); screen as playground (for joking and teasing); and screen as stage (for dramatic play). Creating art and writing were separated into non-play categories (screen as canvas and screen as paper). I, instead, opted to include any act of creation/composition within the "playing to experiment" category, in which I included a creation element. Within this category, I, like Labbo, found evidences of students creating object pictures (p. 374), making organized scenes (p. 375), and engaging in composition with text and letter symbols (which Labbo terms "writing"). However, I did not separate these instances into separate categories, but rather included all creating actions within either the playing to experiment or playing to engage in pretense. This choice was based on the possibility of multimodal composition (Jewitt, 2006; Kress, 2003; Kress & Van Leeuwen, 2006). Furthermore, I detailed additional types of student creations to also include non-representational image compositions and image pile compositions. I did not sort joking and teasing into its own play stance, because joking and teasing seemed to permeate all the play outcomes—playing to sample, experiment/create, engage in pretense—and thus seemed to be part of the social interactions that occurred across all categories of students iPad app interactions (e.g., the Chapter 4 example in which Vera, engaged with *Draw & Tell HD* (2012), added a moustache to a dog and laughed, pointing it out to her tablemate).

Similar to Labbo (1996), I did include a "screen as stage" perspective by delineating a category for "playing to engage in pretense." Perhaps because her research only included a single drawing program, she found "many of the children's staged events were not linear. At times, there was no sense of a beginning, middle, and end, but more a sense of captured fragments of dramatic play that appeared to be inspired by the availability and manipulative ability of clip-art icons and stamps" (p. 370). While my findings did reveal instances of similar non-linear dramatic play fragments, the inclusion of programs with video-recording capabilities allowed for more instances of linear dramatic play experiences. Even so, students in the current study still engaged in brief linear dramatic play fragments, and seemed to engage in pretense-related play less often than in the other forms of play (e.g., The Chapter 4 examples of Tony's experiences with creating little enactments with a partner using *Sock Puppets*, 2012; or on his own using *Draw & Tell HD*, 2012).

My model's innermost sphere of the digital play core with three play outcomes—playing to sample, to experiment and create, and to engage in pretense—does not suggest new kinds of play that are different from traditional forms of play—indeed, even non-digital play research has indicated children's tendencies to explore, experiment, create, or engage in pretense (e.g., Escobedo, 1992; Fahndrich & Schneider, 1987; Fromberg, 1992; Howe, Petrakos, Rinaldi, & Le Febvre, 2005; Hutt, 1971; Wohlwill, 1984; Wolf & Grollman, 1982;). However, my findings suggest that the three types of digital play outcomes (to sample, experiment, and engage in pretense) demonstrated the particular ways children in one classroom, with a particular teacher and researcher, at a distinct, uniquely organized activity center (the iPad station) approached digital play through specific open-ended iPad apps. It is to the larger landscape of play research that I now situate my own study and findings.

STUDY FINDINGS AS SITUATED WITHIN THE EXISTING LANDSCAPE OF PLAY RESEARCH

My model of socially situated dual tablet play is not the first model of children's social interactions around computer play. Wang and Ching (2003) proposed a model they named the “transactional model of social processes and meditational artifacts” (p. 339), in which “children’s social practice emerg[ed] from agents and artifacts, as mediated by social negotiation and artifact transformation and appropriation” (p. 345). In their model, the key parts include the agents (“children’s social goals and intents as individuals and as members of a group”), cultural artifacts (“affordances of computers and other artifacts and social rules in the classroom”), “social negotiation processes and appropriation/transformation of artifacts,” and social practice (“social interaction in spontaneously formed groups at the computer”) (p. 339). In my model, I include the larger cultural contexts of the classroom, as arranged and influenced by the teacher, the arrangement of the iPad station, the multiple influences of children’s personal and social interests, as well as the program content and affordances, and the related play outcomes. Thus, while Wang and Ching focus on the agent, artifacts, and social interaction, I include multiple levels of sociocultural contexts that seem to be interconnected with the “agents,” “artifacts,” and “social practices.”

I suggest that students’ choices, actions, and interactions with open-ended iPad apps occur as examples of children’s *in situ* play—meaning making that is relevant and important in the moment, situated in multiple contextual spheres organized in a particular time and space which offer a unique context for play. Contextual spheres offer certain affordances (and hindrances); at the same time students demonstrate agency as they actively make choices and pursue personal and social interests. These spheres are nested within one another and include permeable boundaries so that actions and interactions may influence and/or be influenced by crossing boundaries. Even the three play outcomes described herein—playing to sample, to experiment/create, to engage in pretense—had permeable boundaries as well, and students flowed within and across these play outcomes as they took actions in their socially, culturally, historically situated experiences.

Students' reflexive tracking was a phenomenon that provided evidence of their navigation within and across the multiple spheres, as they pursued the actions that appeared to be most salient to them in the moment.

The described types of digital play (sampling, to experimenting, and/or to engaging in pretense) were situated within multiple contextual spheres that were connected to players' available choices for meaning-making and social interactions. A multi-level socially situated contextual perspective allows us to consider how children craft their own digital play, following their individual and social interests within a unique classroom and activity center setting. Classroom discourses of choice, hands-on activities, time for play, and social cohesion were contextual features that seemed connected to the types of play observed, and children's changing play interests as indicated through reflexive tracking.

Play—as it occurs for children, and in the unique setting of a classroom—can be taken up in ways that might be different from theoretical play perspectives (e.g., Piaget 1962, 1976; Vygotsky, 1976, 1978) or multidisciplinary play rhetorics (Sutton-Smith, 1997). This is a concept that is not new to the field of play research (see Reifel, 1999). As Reifel (1999) noted, play scholarship—when related to educational practice—is "not just about scientific ideas, but also values, beliefs, cultural expectations, and all sorts of other matters that shape our goals and actions" (p. 204). That includes the values, beliefs, and cultural expectations of the teachers who organize the classroom space, but also of the children who are active players within and across the arranged spaces. Reifel notes the importance of examining teachers' perspectives on, arrangement for, and participation in classroom play opportunities. The evidence from this study supports such a contention, and suggests that simultaneous examination of children's actions as they move within multiple spheres of values, beliefs, and cultural expectations can reveal the complex ways in which children can both take up play in response to the culture and create their own meanings within the existing culture.

My model's acknowledgment of children's active play choices as situated within multiple contextual spheres aligns with the findings of Wohlwend (2013), who noted the nested layers of cultures/discourse—media, school culture, peer culture, early childhood developmentally appropriate practice culture—within which students' play choices were situated. Like Wohlwend's graphic representation of nested layers, my model also includes multiple levels of culture and discourse nested within one another: children's play outcomes nested within their personal and social interests, influenced by reflexive tracking, situated in a specific activity center, encompassed in a particular classroom context. Wohlwend explained that the different levels of culture and discourse in her study "were not wholly separate but existed in overlapping, nested relationships within the classroom. These overlaps made it possible (and also necessary) for children to slide in and out of play identities and to morph the meanings of their played action texts" (p. 7). While I did not examine students' play identities, there were parallel similarities of children's dynamic and changeable play actions, with students sliding easily in and out of modes of sampling, experimenting/creating, engaging in pretense—categories of play into which I sorted children's playful actions.

My sorting of children's actions into these three categories of play occurred not in response to play types specifically ascribed to digital play by earlier research. Indeed, earlier researchers may have categorized children's exploration and experimentation behaviors as non-play activities (e.g., Escobedo, 1992, 1999; Fahndrich & Schneider, 1987; Hutt 1971). I argue, however, that the children in this study believed many of their actions—whether exploratory, experimenting/creating, or engaging in pretense—to be play. The actions they took indicated their varying modes of meaning making as they interacted with a tool that offered digital play experiences, and these actions seemed to them "play" for several reasons. First and foremost, children's actions seemed to be "play" to them because they named it as such. Recall Juan, selecting/sliding/rotating/re-sizing icons actions during early interactions with a given app, as he named his own actions as play, "I'm gonna play there when I'm finished with iPad . . . I'm just playing iPad." Juan himself labeled his own actions as play. Indeed, although the majority of children in this study did not overtly state, as did Juan, any explanation that their actions were play, their choice to come to the iPad station, their interactions with classmates, their active engagement with multiple open-ended apps over a period of time, and their expressions of glee and excitement seem to indicate a "play as disposition" (Rubin, Fein, & Vandenberg, 1983) stance, even when engaging in exploratory and experimenting types of activities.

Students in this study demonstrated additional evidences of "play" as described in Rubin, Fein, and Vandenberg's (1983) explanation of "play as disposition," which included six features: 1) play as "intrinsically motivated," 2) play as "characterized by attention to means rather than ends," 3) play as different to exploration as it is "organism rather than stimulus dominated," 4) non-literal and simulative, 5) "freedom from externally imposed rules, and 6) participant must be "actively engaged in an activity (pp. 698-699). The findings of my study suggest that children were intrinsically motivated, at times, to engage with open-ended iPad apps, as demonstrated by their self-selected presence at the iPad station. Intrinsic motivation was also demonstrated by their persistence in the face of program and/or user difficulties, and their curious and continual explorations and experimentations with apps, and the related tools. Rubin and his colleagues' second feature of "attention to means rather than ends," could be evidenced not only by the extensive amounts of exploration and experimentation engaged in by students, but also by their often fleeting interest in reviewing their past creations. As shared in Chapter 4, students rarely reviewed their in-app recordings or drawings after the initial review. These actions seemed to indicate the students' focus more on the process of exploring, experimenting, or creating (means) rather than the end result of creating an image to share and revisit (ends).

Concerning Rubin, Fein, and Vandenberg's (1983) fourth "play as disposition" characteristic of "freedom from externally imposed rules," several external rules were in place—such as limits on the number of students who could play (two at a time), length of time (not more than 20 minutes), iPad placement (a table that offered parallel, seated interactions), and limits of the programs themselves (e.g., the tools, icons, and program functions pre-programmed). However, students did have some freedom from externally imposed rules due to the classroom setting that allowed for student choice in visiting the center, selecting a partner, choosing apps, and interacting with apps and each other. Students' engagement in "nonliteral" behavior was evidenced by the very use of icons and symbols that are representative of non-present objects. Conversely, students' engagement in acts of "nonliterality" and "simulative" behavior (Rubin et al, 1983) could be contested by my findings of children's more limited engagements in pretense-related play as conceived of by early childhood canon theorists who discussed definitions of symbolic play (e.g., Piaget, 1962, 1976; Vygotsky, 1978) in which objects, settings, and characters are not literal representations of the world. Canonized perspectives of play theory might suggest the element of nonliterality only be applied to pretense-related play. However, in the socially situated digital play of children with open-ended apps, I suggest that the element of "nonliterality" might take on a new meaning in light of children's dynamic manipulation and use of symbols and icons that represent the not-present. Students' manipulation of digital paintbrush, magnets, and crayons, or their tapping of simulated water represent their engagement in "as if" behaviors—it is "as if" they are painting or tapping at fish. However, they are merely manipulating pixilated lights and colors rather than real, liquid paint, or wet water. Their experimentations and creations are real and yet not real—just as a baby doll is simultaneously real and yet not real. In both instances the child must agree that the objects at hand represent something not present—the cloth and plastic represent a real baby, and the pixilated, colored lights represent paint.

In summary, I suggest the students in this study approached the open-ended iPad apps through play, and their play outcomes were connected with their personal interests and the social setting. These participants evidenced dynamic movement through different approaches, and changeable interests across the spectrum of individual to social play. Children's play actions were situated within multiple contextual levels, but those contexts did not dictate or serve as predictors of students' choices. Their choices occurred in dynamic interaction with the classroom environment, the social milieu, the cultural device of a touch-screen tablet, and children's own changeable interests.

LIMITATIONS & IMPLICATIONS

The model presented in this study indicates students' socially situated actions and interactions with open-ended iPad apps as nested within multiple spheres of contextual factors. But as with any study, the arrangement, enactment, analysis, and resulting discussion were constrained in certain ways. In the remaining sections I describe the study's limitations and implications for future study, followed by implications for the classroom.

Limitations & Implications for Future Research

Because the grounded theory model I have proposed in this study indicates the socially situated nature of children's choices and interactions, future research should examine other contexts, classrooms, types of applications, and different groups of students. It might also examine different iPad center arrangements with differing restrictions on time, onlookers, and even iPad placement. Thus, limitations and related implications for future study include consideration of other contexts, different methodologies, and different theoretical frameworks.

Consider Different Contexts

Through the analysis of multiple students in a single classroom with one teacher and one researcher I was able to construct a model of students' socially situated dual-tablet play. However, my study of a single classroom did not allow for comparison against other contexts. To more clearly exemplify the multiple factors in children's technology-related play, including the classroom context, the iPad station center arrangement, and children's personal and social interests, it could be useful to conduct such a study in multiple classrooms with differing arrangements for young children's technology-related play with open-ended iPad apps, or with other types of apps. A multi-site study might allow researchers the opportunity to observe differences in student choices as they are nested within specific classroom contexts. Furthermore, inclusion of different types of apps would allow for a deeper examination of students' varying digital play interests.

In addition, my study focused on the contextual influences of the classroom, teacher, iPad center, and other students, but it did not focus on an important additional contextual factor: students' home experiences. Although I did send home a questionnaire for parents about their own home technology use and their child's digital and non-digital play interests, I did not delve any further into possible home-based contextual influences that might be connected with students' in-class play activities. Genishi and Strand (1990) described a child's computer play activity at school as closely linked to her family culture, and her design choices could be better understood when contextualized with family interactions and values. Future research might better reveal deeper understandings of children's funds of knowledge (Moll, Amanti, Neff, & Gonzalez, 1992) and the sociocultural situated interconnections of children's choices and actions with the additional sphere of family culture.

In addition, I did not closely examine other possible elements guiding children's purposes in their play choices at the iPad station, such as their possible interests in initiating, strengthening, or negating connections with other students, or in exploring power relations, or in pursuing interests that might build on their home-based funds of knowledge. Neither did I examine the choices students might have made had they been allowed to take the iPads into other centers, and use them in different forms of play. The very organization of the study—which paired children in positions to observe what their tablemate was doing—certainly contributed to the ways in which they engaged with the apps and with each other. Chen (2011) found that friendship was an important factor in children's collaborative strategies around computer-based drawing. Therefore, future studies might examine not only device arrangement and access in classrooms, but also the additional element of friendship as connected with children's actions around open-ended apps. Further, future research might include connections between children's digital play interests and the existing research on children's situational and maintained interests (Hidi & Renninger, 2006).

Finally, I did not examine race, class, and gender issues that might have contributed to students' choices and play actions with open-ended iPad apps. I did not engage a critical perspective through which to view students' choices at the iPad station. My study is only a first step toward understanding children's digital play with touch-screen tablets, and future research must include deeper examination into how elements of race, class, and gender might be associated with children's play interests.

Explore Different Methodologies

This study suggests that there is still room for theory building around the topic of play, and that touch-screen tablet play may offer additional nuances to existing play theory, or even suggest alternative play theory. Although grounded theory allowed me to construct a model around children's choices and interactions in a specific digital play situation, I did not engage a close analysis (e.g., discourse analysis) of children's language. Nor did I explore the functions of children's language around digital play—a topic that might reveal more complexity in children's reflexive tracking and their personal interests and social influences. Bhargava and Escobedo (1997) examined the functions of children's language while drawing at the computer, and found four functions of children's language, "child directed, child informing, child inquiry, and expressions" (p. 5). A similar close inspection of children's language and the functions of their utterances while involved in playing to sample, experiment, and engage in pretense might reveal deeper complexity in children's personal/social interests and actions not revealed through the grounded theory approach used in this study.

Furthermore, the current study utilized a Glaserian classic grounded theory approach (1978), in which students were observed with a focus not on classifying personal patterns, but rather on behavioral patterns. This perspective is explained by Glaser (1978), ". . . our work is to type behavior not people. . . This allows the actors in grounded theory to walk in and out of many behavior patterns without being typed as one of them. Our actors can roam unlabeled and unclassified. They can succeed here and fail there and not be failures or successes, deviate here and conform there and not be deviants or conformists and so forth. . . the emphasis is on behavioral patterns, not personal patterns" (p. 69). Glaser later notes that behaviors can be—and usually are—linked to identity. However, the current study does not address identity—yet another limitation. My study is but a first step into understanding more about children's digital play experiences. Future work will benefit from a closer examination of children's choices so as to more deeply understand connections between their experiences, language, cultures, gender, class, and other identity issues.

Alternative methodologies could offer additional insights into children's choices and interactions. Discourse analysis might be utilized in order to more closely examine the language children use as they navigate independently and collaboratively with open-ended apps. Case studies might enable micro-level examinations of children's choices and allow cross-case comparisons. In addition, ethnography might allow close examination of the multiple cultural influences on children's choices and play with open-ended apps.

Consider a Cultural-Historical Activity Theory Approach

After developing and reflecting on my study's model, I found connections between it and a cultural-historical activity theory (CHAT) approach, which would allow for analysis of multiple layers of contexts that could be connected to children's play. A CHAT approach would also allow for a simultaneous consideration of multiple perspectives on play (Schousboe & Winther-Lindqvist, 2013; Van Oers, 2013). While I did not begin my study from this perspective, my findings suggest that future research projects could use a cultural historical activity theory perspective to analyze children's dance between the personal and social contextual factors. Future researchers could also use CHAT as a theoretical foundation that would allow play to be defined as it actually occurs for children as they make meaning *in situ*. Furthermore, a CHAT approach might allow for a closer examination of how context might interpenetrate the activity system.

Implications for the Classroom

In addition to future research implications, the current project also offers implications for teachers wishing to integrate technology within their early childhood classrooms.

Classroom Organization

The model of socially situated dual tablet play described in this study was afforded by a particular classroom context in which the teacher arranged time and space for children to explore and experiment with a variety of materials for an extended period of time. Thus, teachers may want to consider their own perspectives on play in the classroom, and how they might arrange their space to facilitate children's play. They might consider how their classroom space constrains or affords different types of play, children's ability to choose, the activities and materials they think would foster play, and the amount of time they allowed in their schedules for play. Teachers might also examine their perspectives on digital play and how this might be connected to the ways in which students might be afforded opportunities to explore and experiment in technology-related play in their classroom.

iPad Activity Center Arrangement & Available Apps

The findings in this study suggest that children's digital play and social interactions seemed to be connected at least in part with the arrangement of the particular iPad activity center. Teachers might consider how their own iPad station arrangement might or might not foster certain types of play and student engagement. Multiple contextual factors can be considered, including the number and positioning of devices, the preparation (same or different apps) of the devices, and the types of apps to be included. Additional factors include the amount of time students are allowed to participate, how they select to visit, how partners might (or might not) be selected, whether or not onlookers might be permitted, and how students can get help when they have difficulties. These factors might affect how students are able to navigate through the programs and how they might discover new play interests or opportunities.

Teachers might also consider the types of apps they might provide for children and the opportunities and constraints offered by different apps. Teachers could examine apps for the types of play that might be available (drawing, coloring, constructing, enacting, recording, gaming, etc.) and the tools provided within the apps for students to explore. They might also consider the types of icons, the amount of text, and the ease of use for young students with a spectrum of earlier digital play experiences. Finally, teachers might consider the number of and difference between apps they make available to young children with varying interests.

Scaffolding App and Tool Affordances

When programs have lots of options and tools, the additional consideration arises of how best to share unexplored features with players. In the current study, students did help one another and sometimes they even figured out new moves and program affordances by accident—a 'serendipitous *oops*.' Even so, the data showed that students were interested in learning new tasks to extend their play, but without knowing all the possible program affordances, and without a guide to suggest possibilities, some tools and possible actions went undiscovered. Thus, teachers might consider periodic demonstrations of program affordances and tool use so that students would know such possibilities existed and could ask for more help if desired. For example, not all students discovered the screen-capture function (depressing the home button and power button simultaneously to take a 'photo' of the image on screen and save to the camera roll), but for those who did discover and learn this technique it was an oft-used action (though, with my participants, was more for "in the moment" saving/revisiting than for longevity's sake). It allowed students to be in control of saving (or not) their own creations without having to wait for an adult to do it for them.

Considering Reflexive Tracking

Although reflexive tracking was noticed during students' parallel digital play, it is possible it might occur in other spaces as well. Teachers' consideration of the possibility of reflexive tracking between students might influence their structuring of new play experiences for their students. Teachers might consider how to organize new play opportunities so that children could engage with new materials alongside one another, and then keep track of how students' choices might influence each other. The students in this study evidenced many examples of knowledge acquisition from one another in their play experiences with open-ended iPad apps, and indicated the social nature of exploring, experimenting, creating, and engaging in pretense alongside one another. Providing for and examining such opportunities might reveal students' varying individual and social interests toward new and existing play situations, and could aid teachers in scaffolding students for deeper play and learning opportunities.

The Viability of Technology Related Play via Touch-screen Tablets

Finally, the findings in this study suggest that children can engage and play interactively with digital technology tools, and that when afforded opportunities for exploring, experimenting, and creating, they are indeed able to engage in acts of self expression (NAEYC & Fred Rogers Center, 2012). This study offers multiple descriptions of children's individual and social interests around digital play, as well as their choices and actions within a particular sociocultural context. The findings offer examples of "what young children are able to do and how these tools and media can be integrated in a classroom" (NAEYC & Fred Rogers Center, 2012, p. 11). The model suggests that the choices children make and the ways they engage in digital play are situated within multiple levels of contextual influence, and that teachers should carefully consider their own contexts when integrating digital tools for children's play and learning. The digital tool alone—be it a touch-screen tablet, computer, or digital toy—will not "extend and support active, hands-on, creative, and authentic engagement" (p. 11). It seems to offer such possibilities when situated within multiple contextual spheres that offer opportunities and affordances that support such means of authentic engagement.

Appendix A: Consent Forms

Teacher Consent for Participation in Research

Title: Prekindergarteners' Multimodal Literacy, Learning, & Play with iPad Apps

Introduction

The purpose of this form is to provide you information that may affect your decision as to whether or not to participate in this research study. The person performing the research (Holly Carrell Moore) will answer any of your questions. Read the information below and ask any questions you might have before deciding whether or not to take part. If you decide to be involved in this study, this form will be used to record your consent.

Purpose of the Study

You have been asked to participate in a research study about young children's processes as they play and explore various types of drawing and story-telling apps while using tablet touch-screen (i.e. iPad) tablets. The purpose of this study is to understand the processes of children's play, multi-modal literacy, and as they explore/play with iPad applications focusing on various forms of storytelling (i.e. Sock Puppets, Toontastic, Draw & Tell HD, Doodlecast, Scribblepress, DoodleBuddy, Magnetic ABC Letters). This research will help educators and parents better understand the ways children play, communicate, and create stories using technology, and the kinds of literacy opportunities tablet touch-screen devices (i.e. iPads) might provide. As more schools begin to include this type of technology in the classroom, it's important to understand how children explore and create with these new 21st century digital literacy tools and skills.

What will you to be asked to do?

If you agree to participate in this study, you will be asked to

- Allow the researcher to observe your classroom (and take field notes) during literacy centers time
- Assist researcher in disseminating and collecting student consent forms, and parent survey
- Participate in 2-3 informal interviews about about students' literacy experiences, play preferences, story experiences, and technology experiences in the classroom
- During literacy centers time, allow the researcher to set-up and conduct an iPad station (researcher-provided iPad) in which 2 students at a time will come over and learn (with assistance from the researcher) to use and create products using drawing, puppet, and animation applications (application list provided upon request). The researcher-led iPad station will last for approximately five weeks and each pair of students will come to the station up to eight times total. The researcher will work with the teacher to determine the best time and space for the iPad station. Those students who have consented will have their iPad work screen-captured, and may have their interactions video-taped. Those students who do not consent will still come learn at the center, but all research recording equipment will be powered off.
- Your informal interviews will be audio-recorded

- **Total estimated time to participate** in this study is not more than 1.5 hours per day, 2-3 days per week, for not more than 10 weeks total.

What are the risks involved in this study?

- There are no foreseeable risks to participating in this study, as the study will follow along with daily school learning activities.

What are the possible benefits of this study?

- There is no guaranteed benefit to participating in this study, though participation will help us add knowledge to the field about children's play and literacy processes using technology. While there are no guaranteed benefits, participants might benefit from learning about new applications they could use with students, and might gain insight on their students' literacy and technology skills as evidenced through utilization of the study applications.

Do you have to participate?

- No, your participation is voluntary. You may decide not to participate at all or, if you start the study, you may withdraw at any time. Withdrawal or refusing to participate will not affect your relationship with the the school district or The University of Texas at Austin (University) in any way.

- While this project has been reviewed by AISD and by the principal at your school, AISD is not conducting project activities.

Will there be any compensation?

- You will not receive any type of payment for participating in this study.

What are my confidentiality or privacy protections when participating in this research study?

- Interviews of the teacher will be audio-recorded (up to 3 interviews total)
- Your participation in this study will be kept confidential and stored securely, and your name and likeness will be removed from all transcriptions and presentations of data. Transcriptions and data presentations will be coded so that no personally identifying information is visible.
- The students who participate in this study, **may be** video-recorded. Any video recordings will be stored securely and only the research team will have access to the recordings. Video recordings will be kept until all data has been transcribed and coded, and then erased. The data resulting from the students' participation may be used for future research or be made available to other researchers for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate you/your students with it, or with you/your students' participation in any study.
- The participants' application work **will be** screen-captured. Any screen-capture videos will be stored securely and only the research team will have access to the recordings. Screen-capture recordings will be kept until no longer needed for research dissemination, and then erased. The data resulting from students' participation may be used for future research or be made available to other researchers for research purposes not detailed

within this consent form. In these cases, the data will contain no identifying information that could associate you/your students with it, or with you/your students' participation in any study.

- Students who do not consent to participating in the study will still come to the iPad station and learn the applications, but the research video and screen-capturing devices will be powered off.
- The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate you with it, or with your participation in any study.

The records of this study will be stored securely and kept confidential. The researcher, Holly Carrell-Moore, authorized persons from The University of Texas at Austin, and members of the Institutional Review Board have the legal right to review your research records and will protect the confidentiality of those records to the extent permitted by law. All publications will exclude any information that will make it possible to identify you as a participant. Throughout the study, the researcher will notify you of new information that may become available and that might affect your decision to remain in the study.

Whom to contact with questions about the study?

Prior, during or after your participation you can contact the researcher **Holly Carrell Moore** at **(512) 789-2144** or send an email to **hollycmoore@utexas.edu**

This study has been reviewed and approved by The University Institutional Review Board and the study number is **[STUDY NUMBER].**

Whom to contact with questions concerning your rights as a research participant?

For questions about your rights or any dissatisfaction with any part of this study, you can contact, anonymously if you wish, the Institutional Review Board by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

Participation

If you agree to participate, please sign, and return the consent page (page 4) in a sealed envelope to the researcher.

Keep pages 1-3 for your records

The researcher will provide you with a copy of the completed signature page.

Signature:

You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

Signature:____ Date:__________________

Signature of Principle Researcher:_________________________Date:____________

Parent-Child Consent for Participation in Research

Title: Prekindergarteners' Multimodal Literacy, Learning, & Play with iPad Apps

Introduction

The purpose of this form is to provide you information to help you decide if you want your child to participate in this study. The person performing the research (Holly Carrell Moore) will answer any of your questions. Read the information below and contact Holly (hollycmoore@utexas.edu or 512-789-2144) if you have any questions. If you decide your child can participate in the study, this form will be used to record your consent.

Purpose of the Study

You are being asked to decide if your child may participate in a research study about young children's play and literacy learning while using iPad applications (Apps). The purpose of this study is to understand how children learn as they explore/play with iPad apps focusing on various forms of storytelling through drawing and animation. This research will help educators and parents better understand how children play, communicate, and create stories using technology, and the kinds of literacy opportunities tablet touch-screen devices (i.e. iPads) might provide.

What will your child to be asked to do?

- During regular free-choice center time, if your child is interested, he or she may, with a partner, choose to come to an iPad station that includes and iPad with several drawing and dramatic play iPad applications (i.e. Sock Puppets, Toontastic, Draw & Tell HD, Doodlecast, Scribblepress, Doodle Buddy, Magnetic ABC, etc). At this iPad station, the children may choose to explore drawing, story-telling, dramatic play, and/or animation apps. I will be there to assist as needed. This center will be available for students to visit for approximately five weeks and each pair of students may visit at least once per week, and no more than eight times over the five weeks.
- If you consent to your child's participation, his/her interactions at the iPad station **may be** video-recorded (if you allow it) and screen work **will be** screen-captured Video and screen recordings make it easier to look closely at how children explore, experiment, create, and learn to use programs on iPads.
- If you do not want your child to participate, she/he can still choose to come to the iPad station, but the researcher will not video-record or screen-capture the child's activities.
- If your child feels comfortable answering, I'd love to ask him/her questions about his/her favorite applications, things he/she liked and didn't like about the applications, and anything he/she wants to share about their creations.
- The researcher may also collect photographs of non-digital student drawing, writing, stories to compare with the digitally produced drawing and stories.
- **Total estimated time to participate** in this study for an individual child is not more than 15-20 minutes per day, 1-2 days per week, for up to 5 weeks.

- **In addition, you may wish to participate in one part of this research**
  If you would like to, the researcher has a parent survey with questions about your child's technology experiences, play preferences, and literacy experiences at home. This survey

will be sent home at the beginning of the study and can be mailed to the researcher. If you do not want to complete the survey, simply throw it away.

What are the risks involved in this study?

- There are no foreseeable risks to participating in this study, as the study will follow along with daily school learning activities.

What are the possible benefits of this study?

- Your child will receive no direct benefit from participating in this study; however, your child may enjoy playing, learning, and creating using drawing, animation, and storytelling apps on iPads. Your child's participation will help us learn more about children's play, technology, and literacy development. While there are no guaranteed benefits, participants might learn technology skills, oral language skills, storytelling skills, and emergent reading/writing skills.

Does your child have to participate?

- No, participation is voluntary. If she/he does start the study, they may withdraw at any time (simply contact the researcher). Withdrawal or refusing to participate will not affect your relationship with the teacher, researcher, school district, or The University of Texas at Austin in any way.
- Even if your child does not participate in the research, he/she will still be able to come to the iPad station and learn about the applications, but the research video and screen-capturing devices will be turned off.
- While this project has been reviewed by AISD and by the principal at your school, AISD is not conducting project activities.

Will there be any compensation?

- No, there will not be any type of payment for you or your child for participating in this study.

What are my child's confidentiality and privacy protections when participating in this research study?

- Your child's participation in this study will be kept confidential and stored securely, and any presentations of data will never use your child's name or face.
- The students who participate in this study, **may be** video-recorded (or audio recorded). You may choose whether or not she/he may be video-taped on the signature page (page 4) of this form. Any video/audio recordings will be stored securely and only the research team will have access to the recordings. Video/audio recordings will be kept until all data has been transcribed and coded, and then the recordings will be erased. Some videos may be altered to include only children's hands (no faces) and the iPad screen, and these altered videos might be shared in presentations of research findings. They will also be erased after research sharing is complete.
- The participants' application work **will be** screen-captured. Any screen-capture images will be stored securely and only the research team will have access to the recordings. Screen-capture recordings will be kept until no longer needed for research dissemination, and then will be erased.

- The data resulting from participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate you or your child with it, or with your/his/her participation in any study.

All records of this study will be stored securely and kept confidential. The researcher, Holly Carrell-Moore, authorized persons from The University of Texas at Austin, and members of the Institutional Review Board have the legal right to review the research records and will protect the confidentiality of those records to the extent permitted by law. All publications will exclude any information that will make it possible to identify your child/you as a participant. Throughout the study, the researcher will notify you of new information that may become available and that might affect your decision to remain in the study.

Whom to contact with questions about the study?

Prior, during, or after the study you can contact the researcher **Holly Carrell Moore** at **(512) 789-2144** or send an email to **hollycmoore@utexas.edu**

This study has been reviewed and approved by The University Institutional Review Board and the study number is **[STUDY NUMBER].**

Whom to contact with questions concerning your rights as a research participant?

For questions about your rights or any dissatisfaction with any part of this study, you can contact, anonymously if you wish, the Institutional Review Board by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

Participation

Please indicate whether or not you wish your child to participate by checking the appropriate boxes below, and then sign and return the final page (page 4) sealed in the envelope provided. You may return it to your child's teacher, or mail it to the researcher. The teacher will not open the sealed envelopes. As noted above, any participation is voluntary and may be withdrawn at any time by verbal or written communication to the researcher, Holly Carrell Moore.

Keep pages 1-3 for your records

The researcher will send home a copy of the completed signature page.

Signature:

You have been informed about this study's purpose, procedures, possible benefits and risks, and you will receive a copy of this signature page. You may ask questions before you sign, and you may ask questions at any time. You voluntarily agree or disagree to participate in this study. By signing this form, you are not waiving any of your legal rights.

Please check all that apply:

☐ No, my child may not participate in the study. I understand s/he can still visit the iPad station, but no research data will be collected from him/her.

☐ Yes, my child may participate in the study (check additional boxes below)

☐ In addition to the screen-capture recordings of my child's iPad station work, I agree that he/shee may be **video** recorded during the iPad station work.

☐ While my child's iPad station work will be screen-captured, I do not want him/her to be **video** recorded, but only audio-recorded.

☐ I would also like to complete a parent survey form. The researcher may contact me by phone, email, or postal mail at this address (please write contact information in the box below):

Student's First and Last Name AISD Student ID Number

Parent or Guardian Signature Date

Signature of Researcher Date

Appendix B: Teacher Interviews

Teacher Interviews

The questions below are for in-person interviews which will be recorded and transcribed. However, the teacher may not have time for in-person interviews, but still willing to answer questions. In that case, a printed version of each set of questions below (altered slightly to allow space for writing in answers) will be printed and teacher(s) can write directly on the form, via handwriting or if preferred, via email.

Interview 1 ~ Beginning of Study

1) What are some of your students favorite centers?
2) How do you include play in your classroom?
3) What topics/themes have you noticed your students writing/drawing/playing about?
4) What stories have you and your class been sharing lately?
5) What are your thoughts about technology in the classroom? With pre-kindergarten students?
6) What do you personally like to do with technology? Not like to do with technology?
7) What are your goals for you prekindergarten students this year? (For literacy, technology)
8) Talk a little about your students' current literacy skills. Technology skills? Play skills?
9) What skills do you want your students to learn in pre-k?

Interview 2 ~ Middle of Study

1) Talk about what you have noticed about your students' play? Their technology skills? Their narratives/literacy skills?
2) What stories and topics have your students been into lately?
3) Talk a little about your students' writing, drawing, story-telling thus far in the year.
4) Do you have any interesting anecdotes to share?
5) Do you have any concerns about your students' development in various domains (social, technology, literacy, play, etc)?

Interview 3 ~ End of Study

1) (Ask again some of the beginning-study questions: students' favorite things/places/people with whom they play; favorite stories)
2) Share what you have noticed about your students in regards to this project. What was interesting to you? What concerned you? What surprised you?
3) What do you think about your students' app-created stories?

4) What do you think about your students' written/drawn stories (non-digital format)?
5) What do you think about your students' technology skills? Literacy skills? Play preferences?
6) What do you think your students have learned this year?
7) What are you curious to know more about concerning your students' experiences in this project? In their literacy development? In their technology development?

Appendix C: Parent Survey

Parent Survey

Please answer as many of the questions as you would like to. You can return the form to Holly Carrell-Moore by email (hollycmoore@utexas.edu), or in the attached stamped/ addressed envelope. If you have any questions feel free to email Holly or call (512) 789-2144.

1) Describe your child's favorite play activities (what she/he likes to do, who she/he likes to play with, and where they like to play).

2) Describe any reading, writing, listening, watching your child does at home.

3) Does your child have any favorite stories? Favorite tv programs?

4) What are your child's favorite toys/games?

5) What kinds of technology do you use at home? (Check all that apply)
_____Cell Phone
_____Television
_____Music device (cd player, tape player, radio)
_____Digital camera
_____Computer
_____Hand-held games (i.e. Nintendo DS, PSP)
_____Game console (i.e. Wii, Playstation, X-Box)
_____Touch-screen device (i.e. iPad, Kindle Fire, Samsung Galaxy Pad, etc)
_____Other (please describe in the space below)

6) What kinds of technology does your child use at home? (Check all that apply)
_____Cell Phone
_____Television
_____Music device (cd player, tape player, radio)
_____Digital camera
_____Computer
_____Hand-held games (i.e. Nintendo DS, PSP)
_____Game console (i.e. Wii, Playstation, X-Box)
_____Touch-screen device (i.e. iPad, Kindle Fire, Samsung Galaxy Pad, etc)
_____Electronic toys (anything battery operated)
_____Electronic learning devices (i.e. Leapfrog, Leapster, Vtech)
_____Other (please describe in the space below)

7) What do you want your child to get from their schooling experiences in PK?

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Vita

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This dissertation was typed by the author.