YOUNG CHILDREN'S PREFERENCES FOR MUSICAL IPAD APPS

by

Aimee Dorothy Pearsall

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Honors Bachelor in Music Education with Distinction.

Spring 2014

YOUNG CHILDREN'S PREFERENCES FOR MUSICAL IPAD APPS

by

Aimee Dorothy Pearsall

Approved: _____
Dr. Suzanne L. Burton, Ph.D.
Professor in charge of thesis on behalf of the Advisory Committee

Approved: _____
Dr. Alden Snell, Ph.D.
Committee member from the Department of Music

Approved: _____
Dr. Laura T. Eisenman, Ph.D.
Committee member from the Board of Senior Thesis Readers

Approved: _____
Michael Arnold, Ph.D.
Director, University Honors Program

ACKNOWLEDGMENTS

I would like to express my gratitude to my thesis committee: Dr. Suzanne Burton, Dr. Alden Snell, and Dr. Laura Eisenman, who have provided me with helpful criticism, critiques, and guidance throughout the thesis process. A special thank you goes to Dr. Suzanne Burton who has met with me almost weekly for an entire year! I also would like to thank the Undergraduate Research Program, the Honors Department, and the Music Department for awarding me with financial support throughout the research process, allowing me to devote my time and energy to research, as well as to travel to conferences to present my research. Finally, I owe a thank you to my friends and family who have supported me not just through this process, but also through my life, helping me to get to where I am today!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Music-based technology is frequently included in early childhood classrooms as an attempt to incorporate music education in the curriculum. However, there is a lack of research that addresses the educational benefits of music-based tablet applications (apps) for young children. Researchers in this study explored the preferences of four-year-old children (N=16) for music-based apps in a preschool setting. They found that those apps that had a high frequency of visual stimulation, were easy to navigate, and/or had familiar music were preferred by children. Moreover, while children engaged in social interaction, there was a paucity of outward musical engagement. Understanding children's preferences for musical apps while developing appealing apps grounded in music education research will provide developmentally appropriate and interactive music-based technology for young children and educators alike. Additionally, understanding the qualities of musical apps that are most likely to promote musical responses (such as singing, chanting, moving, creating/improvising, or combinations thereof) will help to develop music-based technology that will provide maximum educational benefits for young children.

Chapter 1

LITERATURE REVIEW

Playful Learning

Young children are best engaged in learning through play-based settings, as opposed to formal learning settings. Academic development in children should never trump social development, because they are intertwined; social development yields academic development (Hirsh-Pasek, Golinkoff, Berk, & Singer, 2009). Play promotes development in young children; it encourages problem solving and creativity, builds attention spans, and encourages social development (Hirsh-Pasek, Golinkoff, & Eyer 2003). Additionally, playful learning as opposed to drill-and-practice better motivates children to learn because play engages children's natural instincts to learn through exploration Self-guided, or child-directed play teaches problem solving and creative thinking much more effectively than adult-directed activities (Hirsh-Pasek et al., 2009).

Though most researchers agree that playful learning is essential for children, it is difficult to pin down the type of playful learning that is appropriate. Do all toys yield the same kind of positive child-directed play, or are some more developmentally appropriate than others? Hirsh-Pasek et al. (2003) discourage the use of toys that are marketed as educational, because many of these toys only reward children if they

provide one correct answer. This type of problem is called a convergent problem; convergent problems typically lead to children giving up very quickly. However, divergent problems encourage many correct answers, and thus, generate more perseverance, enthusiasm, and creative thinking. Because of the convergent nature of many "educational toys," it is common that the toy, instead of the child, decides how the child plays and only rewards the child for one specific type of interaction; this ultimately limits a child's creative thinking (Hirsh-Pasek et al., 2003). Hirsh-Pasek et al. 2003 claim that "traditional" toys or games such as pretend play or playing with a ball are of more value than toys that are marketed as educational because they encourage creative thinking. If the labels of toys are potentially deceiving, how does a parent distinguish toys that encourage divergent thinking from those that do not? Do parents consider toys that might be best for their child, or do they simply purchase toys based on their popularity?

In recent years, technology and digital media have consistently ranked as some of the most popular items on parents' lists for major holiday purchases. In one survey of 1,000 U.S. parents with children ages 2-10, 54% of parents planned to buy technology for their children for the 2013 holidays. Additionally, 68% of parents currently purchase or plan to purchase apps for their children; in fact, these parents claim that educational content is the top factor that they consider when purchasing an app (PBS kids, 2013). However, if toys that are marketed as educational actually discourage divergent thinking, what does this mean for educational technology? Could technology and digital media help promote a child's development and education?

The Technology Debate

Technology has been a point of contention between educators, researchers, and parents since the introduction of television in the middle of the twentieth century (Kirkorian, Wartella, & Anderson, 2008). In 1999, the American Academy of Pediatrics issued guidelines that children under the age of two should not be exposed to any screen entertainment because it can "negatively affect early brain development" (Sigman, 2011, p. 267-268). Additionally, many studies have found that there is no educational benefit to children under the age of two interacting with digital media. One study found that children under two years of age who watched a so-called "educational" video regularly did not learn any more words than the control group of children who did not watch the video (DeLoache et al., 2010). This may be because children under 18 months do not understand, and thus learn from television in the same way as older children (Kirkorian et al., 2008). Many studies have identified negative associations related to children viewing television such as language, cognitive, and attentional development problems, titling this phenomenon, a *video deficit* (Anderson & Pempek, 2005).

The guideline by the American Academy of Pediatrics stating that children under the age of two should have extremely limited screen-viewing time is still widely accepted today by educators and researchers alike. However, Anderson and Pempek (2005) suggest that the video deficit disappears by age two and that positive connotations are associated with children over two years of age who view educational television programs. Thus, I will focus my literature review on children over two years

of age. Should teachers introduce technology to children over the age of two in early childhood care centers? Should parents introduce their children to technology in the home? Is any current technology actually educational, and if so, how much of these technologies should children over the age of two be exposed to? Do the positive aspects of using technology in early childhood outweigh the negatives? All of these questions are important to examine when understanding the current debate regarding technology in education.

Taking Sides: Pro Technology

The National Association for the Education of Young Children (NAEYC) recognizes that technology and interactive media are integrated in America's culture, and thus, that young children should develop digital literacy (NAEYC, 2012). Young children need opportunities to develop skills associated with handling technology, just as they would develop the skills needed to handle books. The National Institute for Literacy (2008) suggests that parents and teachers of early literacy should focus on children's literacy with technology as well as with traditional print sources. In fact, the International Society for Technology in Education (2007) recommends that children should develop basic skills associated with technology concepts and operations by age 5.

However, the NAEYC recognizes that screen time should be limited for children over the age of two, and cites recommendations for exact times from other organizations. The White House Task Force on Childhood Obesity and the Early

Childhood Obesity Prevention Policies recommends not more than two hours total of screen viewing time for children over the age of two, because of concerns about a child's lack of activity. Additionally, the Early Childhood Obesity Prevention Policies recommends that educators limit screen-viewing time to fewer than one hour per day for children in full day programs (NAEYC, 2012).

These recommendations are meant to limit children's screen time, not eliminate it completely. Though many parents criticize that young children's interaction with technology may discourage other more productive activities, Attewell, Suazo-Garcia, and Battle (2003) found that using a computer for under eight hours a week in the home is not associated with less time spent reading or playing sports and other outdoor activities. Thus, it seems that technology in small doses is not harmful to children over the age of two.

In fact, advocates for technology in early childhood education argue that technology in early childhood can be beneficial, and that the content of the technology with which children engage is perhaps more important to consider than the amount of time spent engaging with technology (Kirkorian et al., 2008). For example, the Ready to Learn initiative found that some television shows and electronic resources that incorporate reading instruction techniques serve as effective learning tools (Corporation for Public Broadcasting, 2011; Neuman, Newman, & Dwyer, 2010; Pasnik, Strother, Schindel, Penuel, & Llorente, 2007). Additionally, a longitudinal study indicates that early viewing of *Sesame Street* had a beneficial impact on a child's academic and social skills in the subsequent years (Anderson, Huston, Schmitt,

Linebarger, & Wright, 2001). Similar studies on the effectiveness of child-directed educational television also found positive benefits, including more developed problem solving skills associated with watching *Blues Clues* (Kirkorian et al., 2008). Some research even indicates that just like traditional experiences, certain uses of technology can contribute to children's understanding of narratives, song, and graphic representation (McPake, Plowman, & Stephen, 2012). McPake et al. (2012) found that children are developing early expertise in communication and gaining more creative experiences due to technology introduced in the home prior to a child's formal education. It is clear that with specific teaching goals in mind, technological programs can be designed to have long-lasting, positive effects on a young child's learning (Kirkorian et al., 2008).

Researchers who advocate for technology in early childhood claim that all screens are not created equal; digital devices now offer much more interactive options than simply watching a television show (Kleeman, 2010). Wainwright and Linebarger (2006) found that while some television shows and other forms of digital media are worthless, others present a great deal of educational content. While some devices like a television may only encourage convergent thinking, some more interactive devices may encourage divergent thinking, thus creating a more playful and rich learning experience for young children. Researchers Wainwright and Linebarger (2006) claim that as long as the content is valuable, then the format in which it is presented should not matter. However, because of the educational differences between interactive and

non-interactive forms of technology, each screen demands its own criteria for best usage (Kleeman, 2010).

It is important that parents and teachers assess digital media by the same developmentally appropriate principles and practices that guide their teaching in other areas; technology is not an effective teaching tool unless it is used for developmentally-appropriate learning (Van Scoter, Ellis, & Railsback, 2001). It is crucial for educators and parents to make sure that children's interactions with technology and media are playful and support creativity as well as exploration. Early childhood educators should seek out resources about the importance of play in early childhood education and reflect upon what digital media may encourage divergent thinking in children, because it is crucial for children to be able to control the outcome of their experience with technology. For example, the NAEYC does not recommend the use of passive, non-interactive technologies such as television, videos, and DVDs. However, other technologies such as software programs, apps, e-books, the Internet, and content that facilitates active and creative use by children is recommended by the NAEYC (2012). When technology is used appropriately to extend learning from traditional materials, it has been shown to positively impact children's learning and development, both cognitively and socially (Kirkorian et al., 2008).

Taking Sides: Anti-Technology

Though many researchers have found no harmful effects, and even benefits, associated with using developmentally appropriate technology with children, other

researchers have identified negative outcomes. Anderson and Pempek's (2005) research indicates that children learn significantly more from live presentations as opposed to equivalent information presented in a video. This negates the common assumption that age-appropriate and educational television and DVDs will provide children with cognitive advantages. Additionally, Zimmerman, Christakis, and Meltzoff (2007) found that the use of educational DVDs might slow language development. In fact, in 2009, after promising that the Baby Einstein videos were educational and beneficial for early childhood development, Disney offered a recall on all Baby Einstein videos bought since 2004 (Ayres, 2009).

Not only have researchers found cognitive disadvantages associated with children's use of technology, but have also discovered associations with bullying, obesity, social, and attentional factors. A study in 2005 showed implications that television viewing in four-year-olds may lead to bullying in a child's grade-school years (Zimmerman, Glew, Christakis, & Katon, 2005). Heavy use of home computers (more than eight hours per week) is associated with less time spent on sports and other outdoor activities, and thus, with a heavier body mass index among young children (Attewell et al., 2003). House (2004a, 2004b) argues that direct contact with the world is the best way to understand reality; however, technology most often provides an indirect association with reality. In fact, Elkind (2007) and Greenfield (2008) assert that technological progress has led to a regression in meaningful communication between people. Furthermore, Burkhead (2009) and Griffiths (2006) have noticed a decrease in imaginative thinking and authentic play, and though a causal relationship

is difficult to prove, they feel that this should be attributed to children's use of technology. Finally, a reanalysis of longitudinal data collected during the 1980s showed a small correlation between television exposure at the age of three and attention problems at the age of seven (Kirkorian et al., 2008).

Despite these warnings and negative effects associated with technology, preschool children spend nearly three times as long in front of a TV or computer than they do in front of reading materials. Researchers blame this lack of reading on children's exposure to technology (Rideout, Vandewater, & Wartella, 2003). In response to the increasing popularity of digital media for children, Elkind (2007) points out that marketers guilt parents into feeling that children may not be able to compete in today's technological and global economy if they are not exposed to technology. However, there is no evidence that children will not be successful if they are not exposed to digital media early on (Sigman, 2011). The NAEYC (2012) stated that there is a need for more research in order to confirm positive or negative effects of digital media on children's language and vocabulary development, logical-mathematical understandings, problem-solving skills, self-regulation, and social skills development.

Technology in Early Childhood Education

Despite the worries of many educators, parents, and researchers related to young children's exposure to technology, national standards as well as state standards regarding the use of technology in early childhood classrooms are in place. The

National Association for the Education of Young Children (NAEYC) adopted a position statement in January 2012 explaining that the quality of early childhood programs can be greatly enhanced by technology as long as (a) technology is integrated in ways that build upon developmental foundations, and (b) early childhood professionals are aware of both the challenges and opportunities associated with children learning with technology (NAEYC, 2012). Additionally, the International Reading Association issued a position statement in 2009 describing that students will not be fully literate in today's world without the integration of information and communication technologies (ICTs) into the curriculum; it is the responsibility of literacy teachers to teach literacy with regard to digital technology (Hutchison, Beschorner, & Schmidt-Crawford, 2012). Many people feel that technology and digital media should not be incorporated into the classroom, and that it is not developmentally appropriate or necessary. Moss et al. (2007) found that departments that were fully equipped with interactive whiteboards had no effect on pupil performance and that any boost in motivation because of the new technology was short-lived. Additionally, Sigman (2011) suggested that the national standards regarding technology in early childhood are perhaps in place because of the implicit message that children who are not exposed to screen material will be at a developmental and educational disadvantage.

Disregarding the Debate: Focusing on Reality

Numerous researchers have identified both positive and negative aspects regarding children's use of technology both in the home and in the classroom. Though it is important for researchers to explore the positive and negative outcomes resulting from a child's use of technology, it is essential to focus on the reality of the situation. Young children are immersed in practices related to media and are growing up in a digital world. Family members scaffold children's learning as it relates to digital media, both implicitly and explicitly (Marsh et al., 2005). This begins with access; according to the study "Zero to Eight: Children's Use of Media Across America in 2013," (Rideout, 2013) only 8% of families with children aged 0-8 owned an iPad or a tablet device in 2011, and as of fall 2013, ownership has increased to 40%. In fact, as of fall 2013, almost as many children under the age of eight (7%) owned his/her own tablet as parents did (8%) in 2011.

Greater access to mobile devices has led to an increase in usage, and not just for older children, but for younger children as well. Rideout (2013) found that 80% of children ages 0-2 have used a mobile device for media activity compared to 39% in 2011. Stephen, Stevenson, and Adey (2013) found that parents, and in some cases, older siblings, support their children's interest in media and new technologies. These family members provide scaffolding actions and interactions including giving instructions, explaining, praising and monitoring scores, modeling engagement, and

prompting actions and answers (Stephen et al., 2013). Marsh et al. (2005) found that parents are generally very positive about their children's social, emotional, linguistic, and cognitive development, citing that their children learn an immense amount from film and digital media.

Researchers should not only understand parents' attitudes as they relate to a child's access to technology, but also take interest in the types of activities that children explore on mobile media devices. According to Common Sense Media, one of the most common activities related to digital media for children ages 0-8 is utilizing apps. In fact, 50% of children ages 0-8 have used an app; this figure is significant when compared to the 16% of children who had used an app in 2011 (Rideout, 2013).

Children's use of technology and apps is increasing and schools are providing students with increased access as well (MCH Strategic Data, 2012; Rideout, 2013). MCH Strategic Data found in a 2012 survey that 90% of the 5,146 public school districts use electronic white boards, and 54% of these districts use tablet computers and/or eReaders. Ten percent of the districts surveyed planned on purchasing tablet computers and/or eReaders for their districts within 18 months following the time that the survey was administered (MCH Strategic Data, 2012). This is not surprising, considering that parents as a whole feel that media education should be included in the school curriculum from the time that children are very young (Marsh et al, 2005). Cuban of Stanford University explained that despite the lack of research that would clearly demonstrate academic improvement attributed to interactive technology in the

classroom, schools will continue to purchase the newest technologies in order to be viewed as innovative (McCrummen, 2010).

What types of apps do children explore on tablets or other mobile media devices when given access? In the 0-8 age range, children sometimes or often engage with the following apps: educational game apps (42%), games that are just for fun (42%), and creative apps that are for drawing, making music, or playing with photos (38%). The use of media with children under the age of eight is on the rise, and although there may not be many proven benefits of introducing children to apps or other technology at a young age, it is unreasonable to ignore that children are utilizing apps on a daily basis, and parents are attempting to use some of these apps for educational purposes. It is clear that parents value creative apps and are making them available for their children; 45% of children at the age of 2 use creative apps that focus on drawing, making music, and playing with photos (Rideout, 2013).

This yields the question: *How educational are the creative apps that are used by children ages zero to eight?* If 45% of two-year-olds and 38% of children ages 0-8 use creative apps, these apps should be closely assessed for their educational value (Rideout, 2013). Many of the apps that are grouped into the educational category are assessed for their educational value as it pertains to developing reading and math skills. However, it is just as important to assess the creative apps for how those may contribute to a child's art or music education. While there are a great deal of blog posts and informal websites suggesting which musical apps to download onto a child's

tablet, it is important to note that very few formal studies have been completed that assess the educational value of musical apps.

Music Education for Young Children

Before one can assess the educational value of musical apps for young children, one must understand what is developmentally appropriate for children musically. Many researchers have suggested that a diverse listening background comprised of various tonalities and meters is crucial for a young child's musical development (Burton, 2011; Gordon, 2003). They have posited that without such a background children will have difficulty understanding, performing, reading, writing, and improvising music. Gordon (2003) claims that children should listen to music without lyrics in order to best acculturate them to the musical elements of music instead of to language; however, he mentions that it is certainly not harmful for children to listen to music with words. It is crucial for a child to hear a model of a good singing voice, as soon as possible, and to see rhythmic as well as free-flowing body movements by teachers, parents, or other children (Gordon, 2003; Valerio, Reynolds, Bolton, Taggart, & Gordon, 1998).

Another important aspect of a young child's musical development is singing and chanting short musical phrases on a neutral syllable. A teacher or parent should first introduce musical patterns without the expectation of a response. When the child is ready, the child will attempt to imitate the pattern. After the child is able to imitate

patterns, the child will be able to differentiate between patterns that are the same or different and improvise his or her own patterns (Gordon, 2003; Velez, 2011).

Music in the Home

This musical foundation of songs and chants without words as well as short musical patterns certainly set a wonderful musical foundation for children, but it is unrealistic to expect that all parents are laying that type of musical foundation for their children. In fact, de Vries (2009) found that parents admit to a lack of musical knowledge and understanding of how to engage musically with their child. In a case study conducted by de Vries (2009), parents indicated that they play CDs and DVDs with music to their children more than they sing to them. Children's music listening is typically interwoven with many diverse technologies; many times music listening is dependent on music viewing through television, movies, videos, and DVDs. Children use multiple means of technology to listen to various types of music, including videos, CDs, DVDs, portable listening devices, radio, television, and the internet (Roulston, 2006).

Parents most often cite the benefits of recorded music in their home for its entertainment value as opposed to its musical value (de Vries, 2009). This could be related to the lack of attention on early childhood music in the media. Within parenting magazines, the primary messages about the use of music in the home refer to its value for stress reduction and entertainment (Sims & Udtaisuk, 2008). A lack of focus on providing a well-rounded musical environment in the home may also be

related to parental perception about their child's educational setting; parents in one study indicated that they believed that their child's educational setting provided a complete musical experience for their children (de Vries, 2009).

Music in the Early Childhood Classroom

Contrary to the belief of numerous parents, many early childhood teachers do not feel confident about teaching music, and they believe that they lack the skills and musical knowledge to plan music (Suthers 2004; Scott-Kassner 1999). If early childhood teachers tend to feel uncomfortable about teaching music, what is music's role in the classroom? Roulston (2006) found that early childhood educators frequently incorporate music into the classroom in various ways: as background music to free play activities, in group singing activities, and as a way to facilitate certain tasks such as assembling children or cleaning up. She notes that in the classroom she observed, adults in the early childhood classroom determined the music for the day and that it was rare for the teachers to ask the children for song suggestions. Children are typically exposed to different types of music at their daycare centers than they might hear at home (Roulstan, 2006). However, it is important for parents to provide musical experiences in the home and to not assume that their child is receiving adequate music instruction at their day care centers (Gordon, 2003).

Children's Musical Preferences

Because parents mainly expose children to music through recorded means and other commercially available products such as CDs and DVDs for music in the home, it is certainly important to consider children's preferences with regard to recorded music; what do children listen to if given a choice, and what are they listening to at home for the majority of the time? It seems that parents play a wide variety of music to their children; in one study, all but two participants indicated that they played a combination of popular music, classical music, and children's music to their children. Parents play this music to their children for different reasons: (a) the parents enjoy the music, (b) they believe that their children will enjoy the music, (c) they believe that the music will be good for their children, and (d) the music calms their children (de Vries, 2009).

Though parents typically play a wide variety of music to their children, children do tend to prefer one type of music over another. From infancy, children prefer infant-directed (more loving) over non-infant-directed singing (less loving) (Trainor, 1996). Additionally, parents begin to recognize music preferences from their children as early as 10 months to two and three years of age, sometimes to the point that children refuse to listen to certain songs (Roulston, 2006). There is a strong theme across literature that young children prefer rock or more popular music as compared to other styles. Second graders in Brittin's study (2000) preferred musical selections labeled Hip-Hop, Heavy Rock Shuffle, Samba, and Funk2 over other selections

labeled Polka, March, Bluegrass, and Piano Chords. A study of disabled and non-disabled children ages 3-14 indicated that the majority of children's favorite types of songs were rock songs (Jellison & Flowers, 1991). It also is suggested that soundtracks from movies and television are high in popularity among young children (Roulston, 2006).

However, genres of music are not the only musical characteristics that children prefer. Children as a whole (kindergarten through grade eight) prefer music at a faster tempo (Montgomery, 1996). Additionally, Sims (1987) revealed that children (preschool and grades 1-4) except for those in kindergarten preferred faster tempi. A song's familiarity also seems to impact student preference; Demorest and Schultz (2004) found that fifth graders tend to prefer world music songs that are familiar to them. However, it is interesting to note that the absence or presence of lyrics does not seem to affect young children's (4-6 years old) music preferences (Sims & Cassidy, 1997).

The majority of children use a great deal of digital media and technology and are exposed to music through many technological devices (de Vries, 2009; Marsh et al., 2005; Rideout, 2013; Roulston, 2006; Stephen et al., 2013). Researchers have documented the types of music that young children prefer. However, it is still unknown what types of musical apps children prefer and what qualities of musical apps children find intriguing.

Purpose and Research Questions

There is a lack of research related to which musical apps provide the most developmentally appropriate musical experience for children and encourage children to interact with others for a shared musical experience. With the intent of informing the educational community, the purpose of this study was to explore children's interactions with musical apps in a centers-based environment. The specific research questions are as follows: (a) What qualities of musical apps do young children prefer? (b) Which musical apps evoke the greatest amount of musical responses (singing, chanting, and moving) from children? By discovering the qualities of apps that young children prefer and respond to musically, it is the hope that researchers will be able to make recommendations to parents and educators about which apps are of most value for children's early childhood music education.

Chapter 2

THE DESIGN OF THE STUDY

Overview of the Study

Technology and interactive media are both integrated into today's society. Digital devices are part of the culture in which children grow up; they permeate through children's home and school life, as well as throughout the community. As a result, our society puts pressure on educators and parents to provide digital literacy to young children (NAEYC & Fred Rogers Center, 2012). It is possible to utilize technology for learning and growth; however, without careful guidance, usage could potentially negatively impact children's development. Despite the hundreds of musical iPad applications (apps) targeted toward young children, there is a lack of research regarding the educational value of these apps from a music education standpoint. In this sense, educators frequently give children access to apps for which educational benefits are unknown. This discrepancy leads to the issue of quality assurance: *Are the musical apps that are used by early childhood educators with young children developmentally appropriate?*

The purpose of this study was to explore children's interactions with musical apps in a centers-based environment. Specifically, to explore which qualities of

musical iPad apps children prefer and which apps evoke musical interaction and responses.

Methodology

I designed a study to examine young children's preferences for musical apps in an environment that would allow for social interaction. The design of my study was influenced by the research of Sims, Cecconi-Roberts, and Keast (2011), who examined how children utilized their time at a listening center as opposed to other competing centers in an early childhood classroom. This centers design, used by preschools across the United States, allowed the children to interact freely with one another and to stay at each center for as long or short of a time period as they desired.

I completed an online course by the Collaborative Institutional Training Initiative (CITI) entitled, "The Protection of Human Subjects Curriculum," which can be viewed in Appendix A. After identifying a preschool that allows researchers to utilize their facility to conduct educational research, I contacted the director of the school, who approved my study. I submitted for Institutional Review Board (IRB) Approval through the University of Delaware, which can be viewed in Appendix B. Once the study was approved by the IRB, the director of the preschool identified a class that would be the best fit for my research needs. I requested a classroom with primarily three and four year olds because of the many warnings to not expose children under two to digital media. The director of the preschool assigned me a specific class based upon the age request, the informed consent of parents and

caregivers to participate in the study, and the classroom teacher's interest of incorporating iPads into her classroom.

Participants

Sixteen children were in the class. Their ages ranged from 3.1 years of age to 4.41 years of age, with the mean age being 3.85 years. The class included nine male and seven female students. The demographics of the participants were diverse in ethnicity and socioeconomic status.

Role of the Researcher

As the researcher, I was not an active participant at the iPad center. I served as an observer and collected data while the study was active. As the researcher, I limited my interaction with the children to helping with simple tasks that would otherwise hinder the children's experience at the center, such as readjusting the volume of the iPads, and adjusting headphones. I did not teach the children to use the apps.

Setting

The classroom consisted of many different centers, which I adapted for my research needs. The different segments of the room included a reading area, a dramatic play center, and a writing center consisting of a small table surrounded by five chairs. There was also a section with blocks and other small toys, a sensory table that was filled with either sand or water, and a portion of the classroom with tables and chairs

meant for eating and drinking, coloring, learning games or activities, or other various centers that varied from day to day. On the days that I collected data, I changed the writing center into the iPad center because it would only minimally disrupt the normal setup of the classroom. I left the table the way that it initially was positioned: with one length of the table positioned against the wall and with the five chairs along the other three sides of the table. My goal was to minimize contact with the children so as to not influence their play at the iPad table. However, I observed the children from inside of the classroom, as opposed to through the observation window, in order to see and hear the children's interactions.

Procedure

I visited the classroom eight times over a period of four weeks in 2013, with the first visit serving as a trial run. The dates of data collection were as follows: June 10, 12, 17, 19, 21, 24, 26, and 28. Every visit, I arrived at 9:00 AM to set up the iPad center as centers time always began at 10:00 AM. The ending time varied based on the children's stamina; the classroom teacher decided when centers time would end each day. I collected data for the entire duration of centers time, which ranged from 00:47 to 01:25 minutes in length.

To prepare the materials for each visit, I charged each of the iPads, made sure that all of the apps were still functioning correctly and placed in the correct place on the iPad, and checked that the volume was turned up. The classroom teacher and I set up five spaces at the iPad center; this created the opportunity for social interaction

when using the technology. Before centers time on each day of data collection, the classroom teacher explained the options that would be available to the children, and chose children on a volunteer basis for each center. This allowed the teacher to regulate how many children participated in each activity. The teacher never forced a child to stay at a particular center, including the iPad center, as it was a time for free play. When children left the iPad center, the teacher encouraged those who had not previously visited the center to sit down at the table. However, once all of the children had visited the center at least once, the teacher allowed any child who was interested to take the place of the child who left. At the end of centers time, I sanitized each of the iPads, closed all of the open applications, and returned the classroom to its normal set-up.

Materials

Along with the two iPad minis to capture the play at the iPad table, I used iPad stands to prop up the iPads for the video recording. Other materials included sanitizing wipes and screen cleaners for iPads, as well as five pairs of sound-controlling headphones. Additionally, the five iPads with which the children interacted were crucial to the study.

Rationale for iPad App Selection

I found it difficult to decide upon the types and numbers of music apps to include on the iPads because (a) Apple's app store contains over one million apps, and

(b) the lack of current research on the use of iPads for music in early childhood. I chose 12 apps based upon Weber and Singer's (2004) definitions of "kid-friendly" (involving attributes such as dancing and animated characters such as animals, babies, and children) and "less kid-friendly" (void of such qualities) television programs, which were derived from their research on children's television program preferences.

I also chose the apps based on the following musical categories: (a) creating melody (b) creating rhythm, (c) creating loops, (d) familiar songs, (e) ambient sounds, and (f) vernacular instrument bands. Therefore, each of the five iPads at the center contained 12 musical apps, six "more kid-friendly," and six "less kid-friendly," with two apps representing each of the six musical categories.

Using Weber and Singer's (2004) definitions of kid-friendly and less kid-friendly, allowed me to explore if children found the same qualities intriguing when utilizing non-interactive technology as compared to more interactive technology. Categorizing the apps in this way also allowed me to examine if children enjoyed exploring one musical category more than the others.

I performed a content analysis of apps by identifying characteristics within each app, and comparing the similarities and differences between the apps. I made a chart of the most significant characteristics that could be found (or not found) in each app. The categories are as follows: (a) Music begins as app opens, (b) Manipulation needed to create music, (c) Music continues without manipulation after initial play, (d) Ease of navigating the menu, (e) Variety of ways to engage, (f) Verbal communication, (g) Visual stimulation, (h) Familiarity of musical material to children,

(i) Non-Musical Options, and (j) Style of music. I rated the relevance of each characteristic on a 4-point scale for each app ranging from 4=the characteristic was fully present within the app to 1=the characteristic was not present in the app. N/A represents that the app could not be assessed for that particular characteristic. To validate the categories and ratings of the apps, an expert in music education cross-checked the selections. A summary of the characteristics present in each app can be viewed in Table 1:

Table 1 App Classification Chart

	Music begins as app opens	Music continues without manipulation after initial play	Ease of navigating the menu	Variety of ways to engage	Verbal communication	Visual stimulation	Familiarity of musical material	Non-Musical options	Style of music
Virtuoso	1	1	4	1	N/A	1	N/A	1	N/A
Juno's Piano	1	1	3	3	4	3	1	1	N/A
Percussive	1	1	4	2	N/A	1	N/A	1	N/A
Monkey Drum	4	2	2	4	N/A	4	2	4	Afro-Caribbean
Loopseque	1	4	1	1	N/A	2	1	1	Electronic
Toca Band	3	4	4	4	N/A	4	2	1	Funk
iTunes	1	4	4	3	N/A	1	4	1	Children's Songs
Kids Song Collection	4	4	4	3	2	3	4	1	Children's Songs

	Music begins as app opens	Music continues without manipulation after initial play	Ease of navigating the menu	Variety of ways to engage	Verbal communication	Visual stimulation	Familiarity of musical material	Non-Musical options	Style of music
Rockmate	1	1	4	1	N/A	1	1	1	N/A
Bloom HD	2	4	4	1	N/A	2	1	1	Ambient Sounds
Ambient Mood Flashlight	1	1	1	2	N/A	3	1	1	Ambient Sounds
Lily's RockBand	3	4	4	4	N/A	4	3	4	Rock

Description of iPad Apps

Creating Melody. I chose the app Virtuoso Piano Free 3 (Nagy, 2011) for the creating melody category. This app is commonly found on adult and children's tablets, and is a simple way for children to create a melody. It features two keyboards, one above the other, with the notes labeled by letters and a sliding bar above each keyboard to change the range of notes on the screen. Virtuoso's simplicity and lack of characters, animals, movement, and pre-programmed songs clearly classifies it as a less kid-friendly app. I also assigned Juno's Piano (YogiPlay, 2011) to the creating melody category. Juno, a small character, verbally gives the player a choice of three different ways to engage with the app. The child can choose to learn a song, play together with another person, or free play on the piano. If the child chooses to learn a song, Juno jumps on the white piano key, which then changes to pink. She instructs the child to play the same key. Juno continues to add more notes to the song until the child has learned the entirety of the song. The rhythm of each piece is very simple, with all quarter notes and half notes. If the child chooses to play together with another person, then Juno instructs the first person, "mommy or daddy," to play a few notes. Afterwards, the second person is prompted with highlighted pink notes to play the same pattern. This continues with verbal instruction from Juno throughout. If the child chooses free play, Juno instructs the player to make "any music [he/she] want[s]." This setting is very similar to Virtuoso Piano Free 3, except that Juno dances while the

player engages with the piano interface. Because of the child character, the movement on the screen, and the dancing and animation, I classified Juno's Piano as extremely kid-friendly according to my definition based on Weber and Singer's findings (2004).

Creating Rhythm. The two apps I assigned to the creating rhythm category are entitled Percussive (Touch Media Productions, 2010) and Monkey Drum (Flippfly, 2011) with the latter being the more kid-friendly of the two. Percussive allows its user to explore five different types of melodic percussion instruments: the wooden xylophone, glockenspiel, kalimba, marimba, and vibraphone. Users are able to explore each instrument in different octaves and with a soft or hard mallet, if applicable to the instrument. This app is not considered kid-friendly because of the lack of characters, animation, and movement. As the user opens the app Monkey Drum a melodic song with drums plays while an animated monkey plays the drums on the screen. After this opening song, the child is directed to a menu with seven options. The Song Maker option opens a grid with a monkey playing a certain instrument. Players can choose between a bongo, kalimba, or xylophone for the monkey to play. The player controls what the monkey plays by pressing squares within a grid. If the player chooses the Songs option, he/she can listen to songs that they may have saved previously. Three of the other options on the main menu are info, news, and shop, in which players can check to see if they have earned more coins, and can buy new items with those coins. The option Customize allows players to dress up the monkey in a certain style if they have enough coins. After dressing up the monkey and closing the customize option, players are automatically taken to the final option, Play. This option allows players to

play a piano while the monkey moves, dances, and sometimes claps to the beat. After playing a pattern on the piano, the monkey plays it back on either the kalimba, xylophone, or djembe. This app is kid-friendly, because of the pre-programmed music in the beginning, the monkey, the movement, dancing, and animation.

Creating Loops. The third musical category, creating loops, contains two apps, Loopseque (Casual Underground, 2009) and Toca Band (Toca Boca AB, 2013). The app Loopseque initially takes the user to a menu with the following choices: resume, new project, records list, or master class. The first two options direct the user to an interface with one large colorful circle in the center that is divided into multiple sectors. A highlighter circles around the sectors, and when it passes over a section that is selected, it makes a tone. The user has the option to choose a different colorful circle as well, which creates different tones. In this way, after selecting different sectors of multiple circles, the user creates a loop. If the user chooses the records list option on the main menu, it directs the user to recorded loops, and the master class option gives instructions about how to utilize the app. This app is a less kid-friendly app because of its lack of characters, animals, action/movement, dancing, animation, and children. The kid-friendly app for the creating loops category is called Toca Band. When opened, the app presents an empty stage with eight circular spots. 16 characters reside at the bottom of the screen in a line. When the user drags a character to a spot on the stage, that character's specific grouping of sounds begins to loop. Different combinations of characters on the stage create a different combination of sounds, making the song sound different every time. Additionally, the middle of the stage

serves as a solo slot. If a character is dragged to this position, the character shoots into the air, and the user has control over the character's solo; by touching the character while the other characters continue to loop their sounds, it allows the user to "improvise" tonally or rhythmically over the other sounds. This app is kid-friendly because of the characters, animals, movement, dancing, animation, and children featured.

Familiar Songs. The fourth musical category, familiar songs, features the apps iTunes (Apple, 2013) and Kids Song Collection (Kids Game Club, 2013). When a user opens the Kids Song Collection an enticing major melody begins to play, and continues to loop. This app features six songs that users can choose from, entitled, "Twinkle Twinkle," the "ABC Song," "If You're Happy," "Old McDonald," "Jingle Bells," and "Christmas Song," otherwise known as "We Wish you a Merry Christmas." Each song has an appropriate and colorful icon with which it is associated. After choosing a song, the looping music ends, and the chosen song begins. The songs are accompanied by a synthesizer, and sung by an adult. Many times harmonies are present. The words flash across the screen, and characters move slightly throughout the song. Between each verse of each song, the music pauses, and the animation changes. Kids Song Collection is a kid-friendly app because it features recorded music, characters, animals, movement, dancing, animation, and children. I decided to upload the same six familiar songs as featured on Kids Song Collection to iTunes. These six songs came from five different albums, meaning that each album includes different cover art, including pictures of puppies, Dora the Explorer, a

kangaroo, numbers and letters, and Disney characters. These songs all feature children singing with instrumental accompaniment. When in the artist or album view in iTunes, the cover art is visible. However, in the songs view, the cover art is not visible. Therefore, I classified this app as not kid-friendly, because there was no movement, dancing, animation, or children present, and although characters were present in the cover art, it was not possible to interact with the characters on the screen.

Ambient Sounds. For the fifth musical category, ambient sounds, I initially chose the apps Splode BLAST! (Escalation Studios, 2013) and Bloom HD (Opal Limited, 2010). Splode BLAST! contains a menu with five options: one of the options allows the user to play a game, in which the goal is to press a fuzzy round character, called a Splode. When pressed, the Splodes explode and produce an ambient sound. This app is kid-friendly because it features characters, movement, and animation. However, because of delimitations described below, I only made this app available on the iPads on June 10 and 12. Beginning June 12, I replaced the Splode BLAST! with Ambient Mood Flashlight (Kids Place, 2013). When the user chooses the start option on Ambient Mood Flashlight five circles with the following scenes appear: smiling faces and balloons, hearts and red lips, a moon and bats, pink and purple with stars, and a night sky. After choosing one of the five scenes, the objects in the scene begin to move. When the user touches the objects, they make ambient sounds: some rhythmic, some tonal. This app is kid-friendly because of the following features: characters, movement, and animation. I chose the app Bloom HD as the less kid friendly option for the musical category, ambient sounds. Bloom HD gives the user two options when

opened: listen or create. The listen option features a multicolored interface with polka dots that appear at different times; each is accompanied by a tone, and disappears slowly. It also allows the user to touch the screen; the points of contact become new polka dots that are accompanied by a tone. The create option features the same interface, except that it will not play unless the user interacts with the interface. Once the user touches the screen once, the app will loop that same group of pitches, thus allowing the user to create his/her own composition of ambient sounds. This app is not kid-friendly because it does not feature pre-programmed songs, characters, animals, movement, dancing, animation, or children.

Vernacular Instrument Bands. I chose the two apps Lily Rock Band (Alper Ozer, 2013) and Rockmate (Fingerlab, 2011) for the final musical category, vernacular instrument bands. Lily Rock Band features a baby and four animals in a band, as well as five different settings. The first setting allows the user to create sounds when pressing each of the animals or Lily, the baby. The second setting features the band playing a rock tune on guitar, piano, bass, and drums. The third setting prompts the user to "make [his/her] own music." Each character that is pressed plays a different loop on his/her own respective instrument. The fourth and fifth settings prompt the user to "make them go crazy." In these settings, two rock songs play on repeat, and when the user presses a character, he/she makes different non-musical noises. In all five settings, the user can choose to create sparks, drop balloons and colorful streamers from the ceiling, or change the lighting. This app is kid-friendly because of the music that can continuously play, the characters, animals, movement, dancing, animation,

and babies involved. Rockmate features two sets of guitar strings, a drum set, and a keyboard, with choices of chords to change for the guitars and keyboard. In this way, users can play different instruments at the same time to create the sound of a band. This app is not kid-friendly, because it does not feature pre-programmed songs, characters, animals, movement, dancing, animals, or children.

iPad Preparation

After choosing all 12 apps, I uploaded them to the five iPads. I changed each of the screensavers to a plain blue background, so that they looked identical. I locked the screen horizontally, so that the children had to use them facing with the home button to the right. Additionally, I grouped all of the non-musical apps that are not able to be deleted from the iPad into a folder entitled Productivity and dragged it to the dock on the bottom; this folder included the following apps: Messages, Calendar, Notes, Reminders, Maps, Clock, Videos, Contacts, Game center, iTunes, App store, Facetime, Camera, Photo Booth, Settings, Photos, Mail, and Safari (Apple, 2013). Finally, I arranged each of the musical apps on the screen so that they alternated between kid-friendly and not kid-friendly apps on the screen, in the following order from left to right: Virtuoso, Juno's Piano, Percussive, Monkey Drum, Loopseque, Toca Band, iTunes, Kids Song Collection, Lily Rock Band, Rockmate, Bloom HD, and Splode BLAST!

Data Collection

Over the course of three weeks, I visited the early childhood classroom eight times and collected data for a total of 7 hours, 59 minutes, and 25 seconds (07:59:25). Each data collection period ranged between 00:47 and 01:25 minutes. All sessions were video recorded in full on two iPad minis from angles that allowed for the capture of all of the children's interactions with each other and the iPads. Both iPads that functioned as video recorders remained stationary for the entirety of the data collection period. Each session was also recorded in part from a closer angle, with an iPad that was handheld. Additionally, I took notes on the children's behaviors throughout the data collection period in order to supplement the video samples.

Delimitations of Data Collection

After the first day of data collection, I changed the set-up of the iPad center, because the video camera did not always clearly pick up the children's interactions with each other and the iPads. For the remainder of the study, I moved the table away from the wall and put the chairs with their backs against the wall, so as to better record the children's interactions with the camera.

Additionally, I did not upload the songs to the iTunes library (Apple, 2013) until June 12, so although some children opened the iTunes app on June 10, the children were not able to listen to songs until the second day of the study. The app Splode BLAST! (Escalation Studios, 2013) proved to be too difficult for the children to navigate, so I chose a different kid-friendly app, entitled Ambient Mood Flashlight (Kids Place, 2013) to replace Splode BLAST! on the iPads beginning June 12.

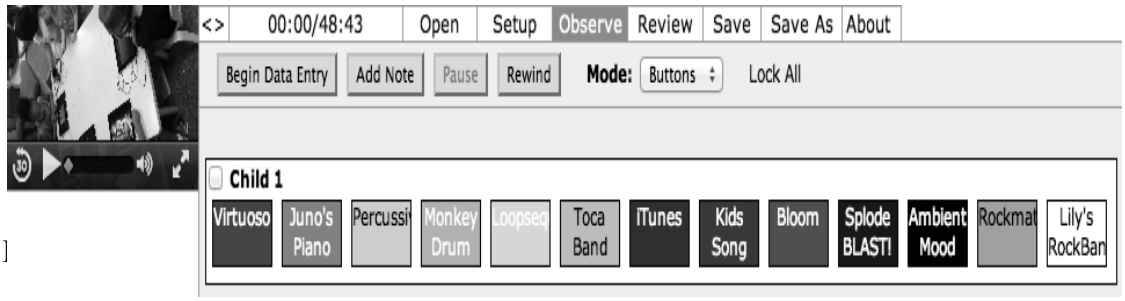
Ambient Mood Flashlight was a good replacement to Splode BLAST! because the menu is much simpler. Splode BLAST! remained on the iPads until after data collection on the 12th.

Limitations of Data Collection

There were a few limitations of data collection throughout the study. On occasion, children sometimes opened the folder with the non-musical apps. I intervened and redirected the children to play with the musical apps.

Data Observation Software

I used the observation software Scribe 4.2 (Duke, 2011) to assist me to analyze the data for the following: (a) the amount of time the children spent on each app, and (b) the musical responses that correlated with each app. The Scribe interface includes seven tabs at the top: open, setup, observe, review, save, save as, and about. I present an image of the interface in Figure 1.



]

The open tab allows the user to open a new or previously saved Scribe file. The setup menu allows the user to enter different subjects, behaviors, and to color code each behavior. The next tab, observe, lists each subject and groups all of the color-coded behaviors as buttons in a box. In this way, while watching the video, the observer can press any of the behavior buttons when the behavior begins, and press it again when it ends. By pressing the note button, the observer can type a time-stamped note that describes more specifics about the moment.

The review tab allows the researcher to see all of the subject's coded behaviors, their start and end times, and the total duration of the time spent by that subject on the behavior. The notes appear in chronological order down the screen. It is also possible to review the results in a timeline form; the viewer can see the color-coded activities as bars below each subject's name with the times above. This creates a visual for which behaviors were most prominent.

Finally, it is possible to view the results in summary form, with the number of times that the subject completed a behavior, the rate/minute, the total amount of time

and the percent of time that the subject spent on a particular behavior, and the average amount of time that a subject spent performing a specific behavior. The save and save as buttons allow the viewer to save his/her work, and the about button provides the information about the program, as well as a space for comments and suggestions and bug reports.

After each time visiting the preschool, I uploaded that day's videos to my personal computer's iPhoto application. Afterward, I dragged each video and picture to the desktop and placed it in a folder labeled with the date of data collection. Finally, I used the Miro video converter, available at <http://www.mirovideoconverter.com/> to convert the videos to MPEG4 versions (.mp4 or .m4v) to upload to the data analysis software Scribe 4.2. Upon completion of data collection, I analyzed the data.

Validity

A graduate student majoring in music education at the University of Delaware verified my data analysis on the software program, Scribe 4.2. The student clicked on 10% (151) of the 1510 time-stamped codes in the Scribe files. After opening each Scribe file, she chose 10% of the total number of codes at random within that particular file to cross-check, which was between 0 and 26 codes. Clicking on the codes automatically loaded the video at those particular time-stamps, which allowed the student to cross-check the codes with the video. She ensured that the codes were accurate, beginning and ending at the correct times. The graduate student agreed with the coding for 149 codes out of 151, meaning that there was a 99% rate of agreement.

I spoke with her about the places in which we disagreed; in both cases, she claimed that the codes should have ended a few seconds before they were time-stamped.

Chapter 3

DATA ANALYSIS AND RESULTS

Parents as well as educators provide young children with digital devices with the intent to educate as well as entertain. Creative apps including music and/or art are some of the most popular apps that parents make available to their children. Children are thus frequently provided with access to multiple musical apps. However, there is a lack of research with regard to developmentally appropriate musical apps for children. Therefore, I designed a study for a classroom of 16 four year olds, and collected data with regard to children's musical app preferences and their musical responses to the apps in order to better understand what musical apps might be the most developmentally appropriate and appealing to young children.

Data Analysis and Results for Question One

I analyzed both research questions using the data analysis software Scribe 4.2, utilizing the program in different ways for both research questions. For the first research question, "What qualities of musical apps do young children prefer?" I coded for each individual child's preferences of musical apps. I designed a template file in Scribe for my first research question. Within this file, I created 16 different subjects on Scribe, one for each of the children in the class. Under each subject, I added 15 different behaviors. I listed each of the 13 apps, as well as a behavior labeled, "off-task on iPad" and "off-task off iPad." These codes allowed me to track behaviors other

than interacting with musical apps on the iPads. The "off-task on iPad" code allowed me to account for the times that the children discovered the non-musical apps and other functions on the iPad, but were still engaging with the iPad. I used the "off-task off iPad" code to keep track of the times that the children sat at the table but did not engage with the iPads; this included actions such as playing with their headphones, talking to others with their headphones off, and playing with things in their pockets.

I color-coded each behavior, and assigned the same colors for the same behaviors listed under the different children's names. That way, when reviewing the data, I could see how long each child spent on each app, by looking at the colors present in the raw data.

I also set up 13 groups in the Scribe file, each titled for the name of one of the apps. Under each group, I listed each child's behavior that was associated with each app. For example, under the group name, "Virtuoso," the behaviors include "Child 1: Virtuoso," "Child 2: Virtuoso," "Child 3: Virtuoso," and so on. These groups allowed me to collect information about the total amount of time that all of the children spent on each app as a group.

After the initial set-up, I saved the file. I re-saved this initial file eight times until I had one file for each date of data collection. Afterward, I uploaded one video per day of data collection to each Scribe file, matching the videos with the Scribe file labeled with the same date.

I coded the data using the "observe" tab on Scribe. After pressing, "begin data entry," I watched the video, focusing on one child at a time, which took roughly three

hours. As a child opened an app, I pressed the behavior button listed under that child's name that corresponded with that particular app. As the child closed out of the app, I pressed the same behavior button, to indicate that the child's behavior had ended. Once I finished coding the entirety of the video for one child's app choices, or behaviors, I moved on to the next child, and repeated the process. After coding for all of the children's behaviors for one video, I coded for the other seven videos in the separate Scribe files.

I created a spreadsheet in Microsoft Excel to organize the vast amount of data. Across the top of the spreadsheet, I listed all of the behaviors (apps) and down the side of the spreadsheet I listed the dates of data collection. After re-visiting the group data in each Scribe file, I filled in the amount of time that the children as a whole spent on each app for each date of data collection. At the bottom of the spreadsheet, I listed the total amount of time that the children spent on each app during all eight days of data collection. The total amount of time that the children spent on each app is listed in Table 2.

Table 2 Total time spent on each app

App	**Time Spent on Each App***
Virtuoso	0:08:53
Juno's Piano	1:26:10
Percussive	0:16:58
Monkey Drum	2:27:41
Loopseque	0:11:33
Toca Band	7:42:23
iTunes	2:54:48
Kids Song Collection	6:10:37
Bloom HD	0:48:12
Splode BLAST	0:09:44
Ambient Mood Flashlight	1:28:10
Rockmate	0:35:32
Lily's Rock Band	5:41:34

*Total amount of iPad center time was 07:59:25.

To find the percentage of time that the children spent on each app, I set up another spreadsheet using Microsoft Excel. I listed the dates of data collection vertically down the left hand side of the chart, and the total amount of time for each day of data collection to the right of each date. In the next column, I listed the total amount of time for each day of data collection multiplied by five. This new "total" was important to use, because I coded for five chairs for each video, meaning that the amount of time spent on each app should be compared to the total amount of time spent collecting data multiplied by five. I finished arranging the chart by listing the

total amount of time on each app for each day, as well as the percentage of time spent on each app per day and total throughout the entirety of the study. Out of the 07:59:25 minutes spent in centers, the children spent the following percentages of time on *each* app: Virtuoso: 0.37%; Juno's Piano: 3.59%; Percussive: 0.71%; Monkey Drum: 6.16%; Loopseque: 0.48%; Toca Band: 19.29%; iTunes: 7.27%; Kids Song Collection: 15.46%; Bloom HD: 2.01%; Ambient Mood Flashlight: 3.68%; Rockmate: 1.48%; Lily's Rock Band: 14.25%. The percent of time spent on each app by the children as a whole can be seen in Figure 2; the black bars represent the "more kid-friendly" apps and the grey bars represent the "less kid-friendly apps."

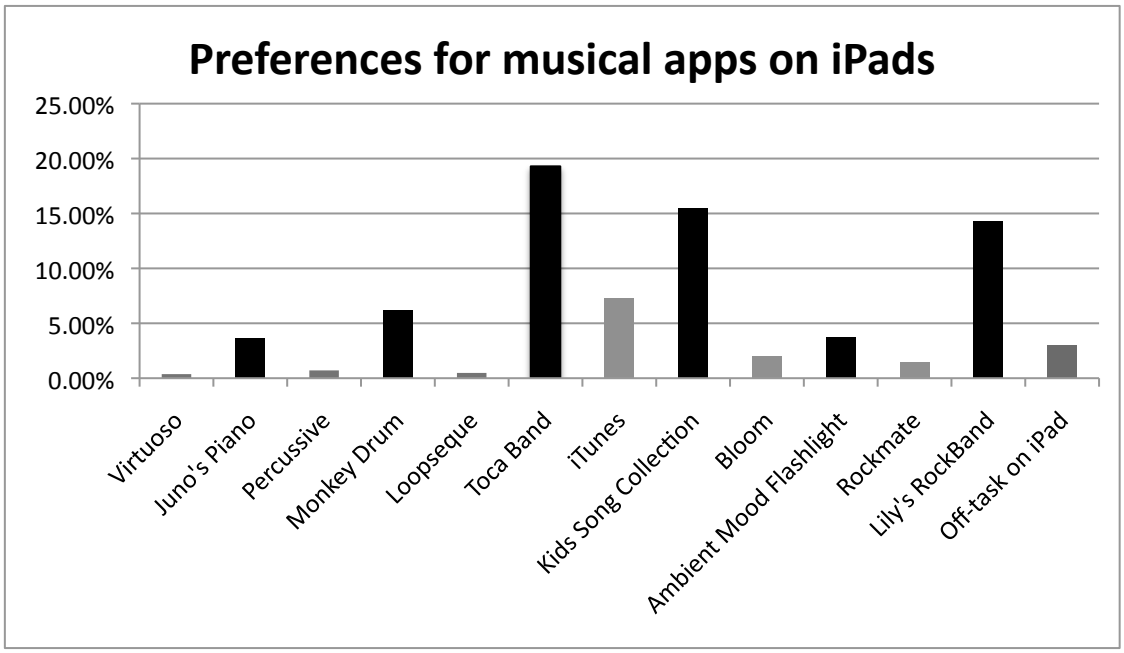


Figure 2 Total time spent on each app

Data Analysis and Results for Question Two

Research question two, "Which musical apps evoke the most musical responses (e.g., singing, chanting, moving) from children?" required a different approach for data analysis than question one. While the data collection remained the same, the data analysis process on Scribe was quite different. Because I was interested in the relationship between the children's musical responses and each iPad app, and not individual children's musical responses, I assigned each app, not child, as a subject on Scribe. Under each subject, I listed codes for both solo musical interaction (musical responses of an individual child to an app) as well as codes for *shared* musical interaction between children, which I indicated with the letters "SI," meaning social interaction. The specific codes listed under each app were: SI Moving, SI Singing, SI Chanting, SI Singing and Moving, Solo Moving, Solo Singing, Solo Chanting, and Solo Singing and Moving. Similar to coding for the first research question, I assigned each behavior a color, and kept that color consistent despite the subject under which the behavior was listed. I saved eight copies of this Scribe file, and titled each with the corresponding dates of data collection. I uploaded the videos labeled with the dates of data collection to the corresponding Scribe file, and then coded for musical responses beginning with the first date of data collection, June 10.

I defined which types of responses would count as musical responses in order to be consistent with my analysis. For an interaction to qualify as SI (social interaction) two or more children needed to make eye contact or say something that indicated that they were playing together musically. Additionally, "Solo Moving" or

"SI Moving" had to clearly be in response to the music, and not simply fidgeting. Movements that I encountered and coded as responses to music was head bobbing, rocking back and forth, fist pumping, dramatic motioning, air drumming, hand clapping, foot stomping, and bouncing up and down. Additionally, I defined chanting as speaking in rhythm. However, while children played on Lily's Rock Band, it was common for one or two of the same children to yell excitedly, "boom boom" at various intervals throughout the song. I did not count this as chanting because though it was in response to the music, it was not in meter or rhythm. For codes that involved singing, I coded for singing if I could tell that the child was attempting to sing, even if it was not in head voice and/or not in tune.

After defining specific musical responses, I opened the observe tab on the Scribe file corresponding with the first date of data collection, and began to code for musical responses as they corresponded to specific apps. When a child provided a musical response, I pressed the behavior code corresponding with the correct subject (app). When the child stopped the musical response, I pressed the button once more. After coding for all of the children's musical responses in each of the eight Scribe files, I set up an Excel spreadsheet to compile the results. I compiled the results in two ways: (a) The amount of time that the children spent giving each type of musical response for all of the apps, and (b) The amount of time that the children gave musical responses to each app individually.

Table 3 Children's musical responses

Type of Musical Interaction	**Total Amount of Time***
SI Moving	0:04:37
SI Singing	0:00:37
SI Chanting	0:00:00
SI Singing and Moving	0:01:58
Solo Moving	0:36:39
Solo Singing	0:19:54
Solo Chanting	0:00:00
Solo Singing and Moving	0:04:16

*Total amount of iPad center time was 07:59:25

Table 3 and Figure 3 depict the amount and percent of time that the children spent giving specific musical responses. Out of 07:59:25, children spent 01:08:01, or 14% of the time giving overt musical responses.

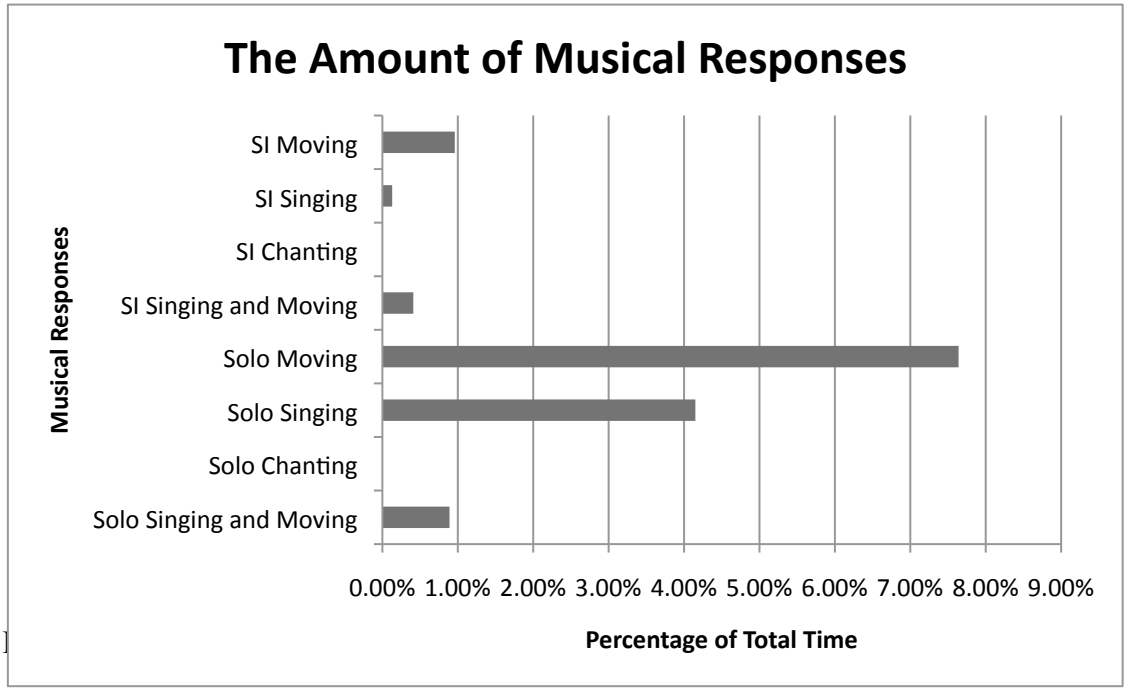


Table 4 and Figure 4 demonstrate the total time of children's musical responses as they related to specific apps.

Table 4 Musical responses to apps

App	**Total Time of all Musical Responses***
Virtuoso	0:00:00
Juno's Piano	0:00:00
Percussive	0:00:00
Monkey Drum	0:00:17
Loopseque	0:00:00
Toca Band	0:00:48
iTunes	0:22:16
Kids Song Collection	0:14:13
Bloom HD	0:00:00
Splode BLAST	0:00:00
Ambient Mood Flashlight	0:00:00
Rockmate	0:00:00
Lily's Rock Band	0:30:27

*Total amount of iPad center time was 07:59:25

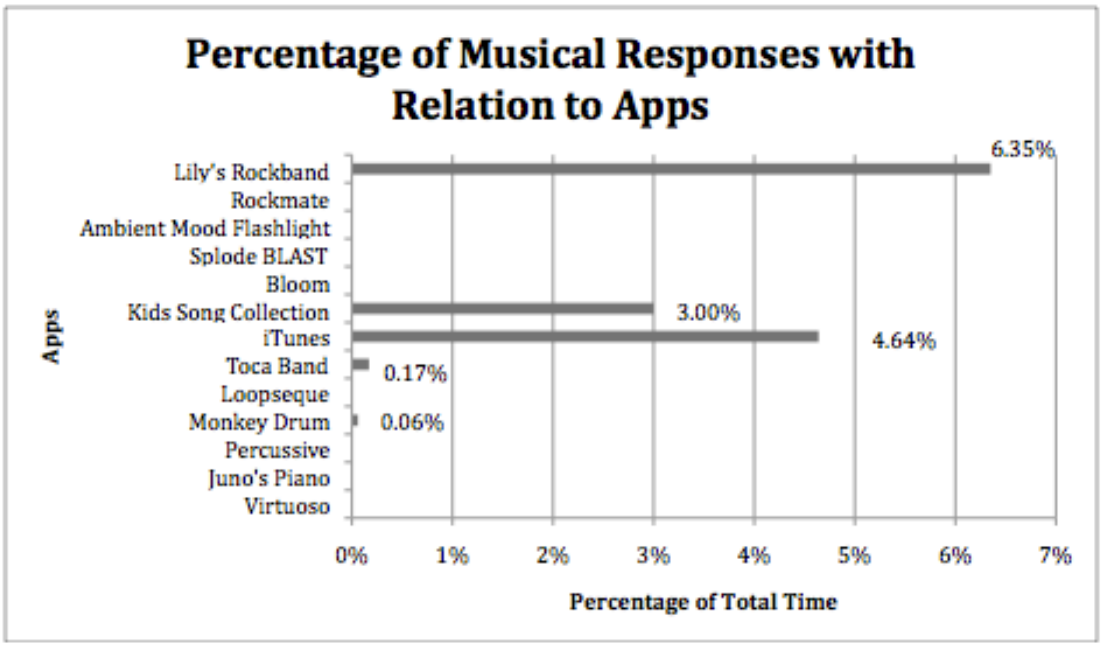


Figure 4 Musical responses to apps

Summary of Results

The data points to children's preferences of kid-friendly over less kid-friendly apps. In particular, children strongly preferred three apps: Toca Band, Lily's Rock Band, and Kids Song Collection (Toca Boca AB, 2013; Alper Ozer, 2013; Kids Game Club, 2013). The children least preferred the apps Virtuoso, Percussive, and Loopseque (Nagy, 2011; Touch Media Productions, 2010; Casual Underground, 2009; Escalation Studios, 2013).

Children provided overt musical responses for a very small amount of time out of the entirety of the data collection period (14%). Children moved in response to the music more than they sang, and they never rhythmically chanted. The children spent 00:07:12 (1.5% of the time) interacting socially in a musical context (singing, moving, or singing and moving together). Anecdotally, I noticed that children socially interacted through verbal means and social referencing.

By comparing children's preferences for each app with the App Classification Chart (Figure 1) I was able to determine which qualities of musical apps children preferred. Children preferred the following qualities within musical apps: music continuing without manipulation, ease of navigating the menu, variety of ways to engage with an app, high amount of visual stimulation, and familiarity of musical material.

Chapter 4

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Technology and interactive media are an integral part of today's society, with parents as well as educators providing young children with digital devices intending to educate as well as entertain. Creative apps including music and/or art are some of the most popular apps that parents make available to their children (Rideout, 2013). However, there is a lack of research with regard to developmentally appropriate musical apps for children. To better understand the technology that would be the most developmentally appropriate and appealing to young children in a musical setting, I designed a study to explore children's preferences as well as musical responses to apps.

Using Scribe 4.2 (Duke, 2011) I traced the preferences and trends in app choice for individual children and for the group of children as a whole and determined the qualities of the children's preferred and least-preferred apps. Additionally, I compiled the children's musical responses to apps, with musical responses including movement, singing, and chanting. I accounted for both individual musical responses and musical responses given in small groups as a means of socializing. Finally, I compiled the frequency of each type of musical responses, as well as which apps promoted the greatest amount of overt musical responses.

Conclusions

Conclusions in this study cannot be generalized to a larger population, but may be transferrable to a setting similar to the one in which this study was conducted. The purpose of this study was to explore children's interactions with musical apps in a centers-based environment. With this in mind, I have derived four conclusions: (a) Children most prefer apps that are visually stimulating, but of a convergent nature that allow them to listen to music without requiring a great deal of manipulation, (b) Apps that evoke musical responses are those that feature vernacular and/or familiar music, (c) Incorporating musical apps in a centers-based environment encourages little musical interaction between children, and (d) Many popular music apps for young children, especially those with which the children engaged in this study, do not encourage a diverse array of overt musical responses (singing, chanting, moving, and combinations thereof).

Children's app preferences. Children most prefer apps that are extremely visually stimulating, but of a convergent nature that allow them to listen to music without requiring a great deal of manipulation. This is worrisome because researchers who specialize in early childhood development strongly discourage a children's use of toys/technologies that is of a convergent nature, because they do not encourage creative thinking (Hirsh-Pasek et al., 2003). This yields the question: How would one design a divergent musical app that would appeal to children?

Children's responses to apps. Apps that evoke musical responses are those that feature vernacular and/or familiar music. This is not surprising considering the strong theme in the literature involving children's musical preferences for rock music, or vernacular music, over other genres (Britten, 2000; Jellison & Flowers, 1991). Despite these preferences, most early childhood music classes do not include rock

music, nor do researchers recommend using rock music as the basis for an early childhood music class, not because researchers have found it harmful, but because it is a widely unexplored area of study (Gordon, 2003; Valerio, Reynolds, Bolton, Taggart, & Gordon, 1998). This gives way to the question: If given the option between an app that plays songs that have been made familiar to children in a traditional early childhood music classroom setting and an app that contains rock music, which app would the children prefer?

Apps and children's musical interaction. In this study, incorporating musical apps in a centers-based environment encouraged little musical interaction between children. Children spent only 1.5% of the time interacting socially in a musical context (singing, moving, or singing and moving together.) Though children often made it clear that they were "playing together," on certain apps, and even started and stopped the apps/music concurrently, they did not often interact musically. This may very well relate to the fact that the children could not perceive exactly what the other children could hear, thus lessening a child's tendency to interact musically (sing, dance, or chant together). This begs the questions: Would the frequency of social musical interactions increase if the children did not utilize headphones? Would individual musical responses, especially movement, increase if children were not "attached" to their iPads via headphone chords? The idea of children not using headphones in an early childhood music classroom poses a problem of practicality, because five iPads playing different music in tandem would not provide for a controlled classroom environment. Thus, it is doubtful that teachers would utilize an iPad center for music play without headphones, which could be the probable limitation on the musical social interaction, which can be a meaningful part of music play.

Apps and the promotion of musicking. Many popular music apps for young children, especially those with which the children engaged in this study, do not encourage a diverse array of overt musical responses (singing, chanting, moving, and combinations thereof). Children responded musically to the iPad apps for a very small amount of time out of the entirety of the data collection period (14%), and spent 0% of their time at the iPad center chanting in response to the musical apps. Chanting has been cited as a critical part of musical development (Gordon 2003). While children spent more time singing as compared to chanting at the iPad center, tonal responses to the iPad apps were minimal (5.58% of the time).

Additionally, both tonal and movement responses to the apps were not nearly as varied as one would be expect to observe in an early childhood music class. Children only gave tonal responses to familiar music, and the responses consisted of the children attempting to sing along. All tonal responses by the children were in major tonality because the apps only featured music in major tonality and duple meter. These apps did not encourage the following varied musical responses that are considered to be developmentally appropriate: children singing the resting tone (the tonal center of the song), children exploring head voice through sirens or other means, or children singing short tonal patterns (Gordon, 2003; Velez, 2011).

With regard to movement, children mostly attempted to move a part of their body to the beat, and while this is an important skill to develop, it is also crucial for children to explore the various stylistic efforts of moving such as space, weight, time, and flow (Gordon, 2003). The apps used in this study did not elicit the same types of tonal, movement, or rhythmic responses that would be considered developmentally appropriate by early childhood researchers.

Summary

Musical apps are not a replacement for early childhood music classes because of the lack of developmentally appropriate, varied overt musical responses that they elicit. For the most part, children remained sedentary throughout the data collection period, preferring apps that required little manipulation, and rarely responded to the apps through movement. This not only yields the problem that children preferred apps of a convergent nature, and therefore were not learning critical problem solving techniques while engaging with the apps, but also that children did not provide a diversity of movement responses that are considered crucial aspects of developmentally appropriate musicking. Finally, the frequency of overt musical responses such as singing, moving, and chanting is not congruent with what is expected with regard to developmentally appropriate musicking for young children. Some data collection periods contained over 40 minutes of children interacting with the musical apps before any child gave a single musical response. In fact, many children interacted with the apps over the entire course of the study without ever giving a single musical response. This lack of consistent and varied musical responses both by individual students and groups of students points to clear implications for educators, parents, and researchers.

Implications for Practice

Parents, guardians, and early childhood educators will continue to provide children with access to technological devices with the intent of providing their children with educational entertainment (edutainment.) There is no exception for music as a content area. This study is only one glimpse at the potential shortcomings of music technology to provide a well-rounded and educational experience for young

children. Parents, educators, and guardians of young children are potentially unaware of the limitations of musical apps, and it is important for people who provide young children with access to these apps to be informed of their benefits and limitations.

If technology will be used to supplement traditional music education in early childhood settings, the quality of music education apps for young children should be of the highest standard. App developers should work side-by-side with music educators to create apps that will encourage children's musical responses as found in the literature: rhythmic chanting, singing patterns, moving with various efforts, and an emphasis on the resting tone of songs. In the simplest sense, apps should at least include songs and chants in various tonalities and meters so that children are exposed to a diverse array of music (Gordon, 2003).

The music apps I surveyed were limited to almost solely songs in major tonality and duple meter, and no songs or chants in the other tonalities (Dorian, Phrygian, Lydian, Mixolydian, Aeolian, Harmonic Minor, or Locrian) or meters (triple or unusual meter). This severely limits the provision of a rich tonal and rhythmic foundation, and thus, the musical responses of children. App developers should create apps that contain selections of music in a vast array of meters and tonalities with the intention of promoting varied developmentally appropriate musical responses from children. Additionally, early childhood teachers should be informed about the shortcomings of current musical apps, so that they are aware that music apps should not serve as a substitute for a traditional form of early childhood.

Apps should not only contain qualities that are likely to promote an array of musical responses, but contain qualities that make the apps appealing to children, so that children prefer and spend more time on the apps that are likely to elicit musical responses in various tonalities and meters as opposed to those that are not likely to elicit varied musical responses. In this sense, apps for music education purposes should have some or all of the following qualities that were found in this study to be appealing to children, such as menus that are easy to navigate, a variety of ways to engage, visual stimulation, some familiar musical material, music that continues without manipulation, animated characters such as animals, babies, or children, and/or dancing.

Early childhood music education in a traditional sense has a valuable role in society. However, if early childhood educators and parents choose to use musical apps and technology in lieu of traditional early childhood music classes, these apps must hold educational value and promote a child's musical development. Imagine if children engaged in traditional early childhood music classes and supplemented their education with developmentally appropriate musical apps! Apps could be designed with the intent to supplement early childhood music classes, containing songs/chants that are used in the classes with multiple options for the children to respond musically in ways that are recommended by researchers in the field of early childhood music education.

Suggestions for Future Research

The outcomes of this study call for new music education apps targeting young children to be designed. Researchers should conduct a similar study with new apps: some that are based on best practice for early childhood music education, and some that are not. Will children prefer the apps that encourage the most musical responses and that are the most educational from a music perspective, or will they spend time with the apps that evoke less musical responses? It is the hope that through a cyclical process of research and app design, multiple apps that evoke a variety of developmentally appropriate musical responses will become popular choices for early childhood educators and parents to provide to children.

Researchers should not only delve into the topic of musical apps, but should also strive to better understand the social implications of incorporating an iPad center into the early childhood classroom. Through anecdotal observation, it was clear that children socially interacted a great deal more through verbal means and social referencing than they interacted with each other musically. Not only did children play together on the iPads, saying things such as, “Play rock baby with me!” but they also worked together in a cooperative learning environment in which there was very little adult involvement, helping each other to solve problems. As a follow-up to this research, I recommend that researchers conduct a similar study, but analyze the data from both a musical and a social perspective: analyzing the social interactions between children at the iPad center. Researchers could compare the frequency of social

interactions to the frequency of musical interactions between children. Additionally, a study that compares the social interaction between students at an iPad music center to the social interaction at other centers would be interesting to observe whether an iPad center has "staying power" in light of children's play preferences.

Technology can hold educational value, even in a musical sense. However, from a music education perspective, musical technology/applications targeted toward young children need to be improved. Future research on the topic of young children and music-based applications will continue to reveal the educational value of current and future music apps and other forms of technology for young children.

This research has provided an insight into the controversy regarding young children's use of technology, particularly with regard to using musical iPad applications in a centers-based setting. Yet, the problem is still not solved. Musical iPad applications do not promote the diversity or frequency of musical responses that would be typical in an early childhood music class, which indicates that these applications should not be viewed as a replacement for early childhood music instructors. Even if these applications are used as a supplemental form of education, parents and educators must be informed of the shortcomings of these applications. With the cooperation of music researchers, educators, and app developers, it is possible to develop applications that encourage a variety of musical responses and are appealing to children, thus fostering their musical growth at a critical juncture in their lives.

REFERENCES

Alper Ozer (2013). Lily Rock Band (Version 1.4) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/lily-rock-band/id481108864?mt=8

Anderson, D. R., Huston, A.C., Schmitt, K., Linebarger, D.L., & Wright, J.C. (2001). Early childhood television viewing and adolescent behavior: The recontact study. *Monographs of the Society for Research in Child Development, 66(1,* Serial No. 264).

Anderson, D., & Pempek, T. A. (2005). Television and very young children. *American Behavioral Scientist*, *48*(5), 505-522. doi:10.1177/0002764204271506

Apple (2013). iTunes (Version 11.1.5) [Mobile application software]. Retrieved from https://www.apple.com

Apple (2013). [Mobile application software]. Retrieved from https://www.apple.com

Attewell, P. A., Suazo-Garcia, B., & Battle, J. (2003). Computers and young children: Social benefit or social problem? *Social Forces*, *82*(1), 277-296.

Ayres, C. (2009). Disney offers refund after furore over Baby Einstein DVDs. *The Times.* Retrieved from http://www.thetimes.co.uk/tto/news/world/americas/article2001483.ece

Brittin, R. V. (2000). Children's preference for sequenced accompaniments: The influence of style and perceived tempo. *Journal of Research in Music Education*, *48*(3), 237-248. doi:10.2307/3345396

Burkhead, T. (2009). We've bred a generation unable to think. *Times Educational Supplement.* Retrieved from http://www.tes.co.uk/article.aspx?torycode=6008340

Burton, S. L., (2011). Language acquisition: A lens on music learning. In S. L. Burton & C. C. Taggart (Eds.), *Learning from young children: Research in early childhood music.* (pp. 23-38). Lanham, MD: Rowman & Littlefield Education.

Casual Underground (2009). Loopseque (Version 2.9.1) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/loopseque/id384127919?mt=8

Corporation for Public Broadcasting. 2011. *Findings from Ready to Learn 2005–2010.* Washington, DC: Author. Retrieved from www.cpb.org/rtl/FindingsFromReadyToLearn2005-2010.pdf

DeLoache, J., Chiong, C., Sherman, K., Islam, N., Vanderborght, M., Troseth, G. L., & O'Doherty, K. (2010). Do babies learn from baby media? *Psychological Science, 21*(11), 1570-74.

Demorest, S. M., & Schultz, S. J. (2004). Children's preference for authentic versus arranged versions of world music recordings. *Journal of Research in Music Education*, *52*(4), 300-313. doi:10.1177/002242940405200403

de Vries, P. (2009). Music at home with the under fives: What is happening? *Early Child Development and Care*, *179*(4), 395-405. Retrieved from http://eric.ed.gov

Duke, R. (2011). SCRIBE: *Simple Computer Recording Interface for Behavioral Evaluation.* Austin, TX: Teaching and Learning Associates.

Elkind, D. (2007). *The hurried child: Growing up too fast too soon,* (3rd ed.). Cambridge, MA: Da Capo Press.

Escalation Studios (2013). Splode BLAST! (Version 1.0.3) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/splode-blast!/id540423416?mt=8

Fingerlab (2011). Rockmate (Version 1.3.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/rockmate/id417415477?mt=8

Flippfly (2011). Monkey Drum (Version 1.2.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/monkey-drum/id483225765?mt=8

Gordon, E. E. (2003). *A music learning theory for newborn and young children*. Chicago: GIA Publications.

Greenfield, S. (2008). *ID: The quest for identity in the 21st century.* London: Sceptre/Hodder and Stoughton.

Griffiths, S. (2006, January 29). Failing to teach them how to handle real life. *Sunday Times.* Retrieved from http://www.timesonline.co.uk/tol/news/article721863.ece

Hirsh-Pasek, K., Golinkoff, R. M., Berk, L. E., & Singer, D. G. (2009). *A mandate for playful learning in preschool: Presenting the evidence*. New York: Oxford University Press.

Hirsh-Pasek, K., Golinkoff, R. M., & Eyer, D. E. (2003). *Einstein never used flash cards: how our children really learn--and why they need to play more and memorize less*. Emmaus: Rodale.

House, R. (2004a). Countering tele-visual assault: Healthy sensory nourishment for a post-television age. *The Mother, 15,* 34-37.

_____(2004b). Television and the growing child: A balanced view? *New View, 32,* 21-25.

Hutchison, A., Beschorner, B., & Schmidt-Crawford, D. (2012). Exploring the use of the iPad for literacy learning. *The Reading Teacher*, *66*(1), 15-23. doi:10.1002/TRTR.01090

International Society for Technology in Education. (2007). *NETS for Students 2007 Profiles.* Washington, DC: Author. www.iste.org/ standards/nets-for-students/nets-for-students-2007-profiles.aspx#PK-2

Jellison, J. A., & Flowers, P. J. (1991). Talking about music: Interviews with disabled and nondisabled children. *Journal of Research in Music Education*, *39*(4), 322-333. doi:10.2307/3345751

Kids Game Club (2013). Kids Song Collection (Version 1.5) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/kids-song-collection-interactive/id531836505?mt=8

Kids Place (2013). Ambient Mood Flashlight [Mobile application software]. Retrieved from https://itunes.apple.com/us/app

Kirkorian, H. L., Wartella, E. A., & Anderson, D. R. (2008). Media and young children's learning. *The Future of Children*, *18*(1) 39-61. Retrieved from https://www.princeton.edu/futureofchildren/publications/docs/18_01_03.pdf.

Kleeman, D. (2010). “A screen is a screen is a screen” is a meme. *Huffington Post* [blog]. Retrived from www.huffingtonpost.com/david- kleeman/a-screen-is-a-screen-is-a_b_792742.html

Marsh, J., Brooks, G., Hughes, J., Ritchie, L., Roberts, S., & Wright, K. (2005). Digital beginnings: Young children's use of popular culture, media and new technologies. *Digital beginnings*. Retrieved from http://www.digitalbeginnings.shef.ac.uk/DigitalBeginningsReportColor.pdf.

McCrummen, S. (2010, June 11). Some educators question if whiteboards, other high-tech tools raise achievement. *The Washington Post.* Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2010/06/10/AR2010061005522.html

MCH Strategic Data. (2012). *2012 School Technology Survey Briefing.* Retrieved from http://mchdata.com/collateral/white-papers/MCH-2012-School-Technology-Survey-Briefing.pdf

McPake, J., Plowman, L., and Stephen, C. (2012). Pre-school children creating and communicating with digital technologies in the home. *British Journal of Educational Technology 44*(3), 421-431. doi:10.1111/j.1467-8535.2012.01323.x

Montgomery, A. P. (1996). Effect of tempo on music preferences of children in elementary and middle school. *Journal of Research in Music Education, 44(2),* 134-146.

Moss, G., Jewitt, C., Levaãiç, R., Armstrong, V., Cardini, A., & Castle, F. (2007). The interactive whiteboards, pedagogy and pupil performance evaluation: An evaluation of the Schools Whiteboard Expansion (SWE) Project, London: London Challenge, Research Report No. 816, Department for Education and Skills

National Association for the Education of Young Children. (2012). Technology and interactive media as tools in early childhood programs serving children from birth through age 8. *Spotlight on Young Children and Technology*. A. Shillady and L. Schoenberg (Eds.). Washington, DC: National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media, 2012. 61-70. Print.

Nagy, P. (2011). Virtuoso Piano Free 3 [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/virtuoso-piano-free-3/id391994966?mt=8

National Institute for Literacy. (2008). *Developing early literacy: Report of the National Early Literacy Panel. A scientific synthesis of early literacy development and implications for intervention.* T. Shanahan, Chair. Louisville, KY: National Center for Family Literacy.

Neuman, S.B., E.H. Newman, & J. Dwyer. (2010). *Educational effects of an embedded multimedia vocabulary intervention for economically disadvantaged pre-k children: A randomized trial.* Ann Arbor, MI: University of Michigan. Retrieved from www.umich.edu/~rdytolrn/pdf/RTL2021210.pdf

Opal Limited (2008). Bloom HD (Version 2.1.1) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/Bloom HD/id292792586?mt=8

Pasnik, S., Strother, S., Schindel, J., Penuel, W.R., & Llorente, C. (2007). *Report to the Ready To Learn Initiative: Review of research on media and young children's literacy.* New York; Menlo Park, CA: Education Development Center; SRI International. Retrieved from http://ctl.sri.com/publications/downloads/EDC_SRI_Literature_Review.pdf

PBS Kids: Tablet takeover. (2013). *PBS: Be more*. Retrieved from http://www.pbs.org/about/news/archive/2013/holiday-tech-survey/

Rideout, V.J., Vandewater, E.A., & Wartella, E A. (2003). Zero to six: Electronic media in the lives of infants, toddlers and preschoolers, Kaiser Family Foundation Report, 28 October

Rideout, V. (2013). Zero to eight: Children's media use in America 2013. *Common Sense Media*. Retrieved from http://cdn2-d7.ec.commonsensemedia.org/sites/default/files/uploads/about_us/zero-to-eight-20131.pdf

Roulston, K. (2006). Qualitative investigation of young children's music preferences. *International Journal of Education & the Arts, 7*(9). Retrieved from http://ijea.asu.edu/v7n9/.

Scott-Kassner, C. (1999). Developing teachers for early childhood programs. *Music Educators Journal, 86*(1), 19–25.

Sigman, A. (2011). Does not compute, revisited: Screen technology in early years education. In R. House (Ed.), *Too much too soon? Essays on early learning and the erosion of childhood.* Stroud: Hawthorn Press.

Sims, W., & Cassidy, J. W. (1997). Verbal and operant responses of young children to vocal versus instrumental song performances. *Journal of Research in Music Education, 45*(2), 234-244.

Sims, W. L., Cecconi-Roberts, L., & Keast, D. (2011). Preschool children's uses of a music listening center during free-choice time. In S. L. Burton & C. C. Taggart (Eds.), *Learning from young children: Research in early childhood music* (pp. 131-139). Lanham, MD: Rowman & Littlefield Education.

Sims, W. L., & Udtaisuk, D. B. (2008). Music's representation in parenting magazines: A content analysis. *Applications of Research in Music Education*, *26*(2). 17-26. doi:10.1177/8755123308317682

Sims, W. (1987). Effect of tempo on music preference of preschool through fourth grade children. In C. Madsen & C. Prickett (Eds.), *Applications of research in music behavior* (pp. 15-25). Tucaloosa: University of Alabama Press.

Stephen, C., Stevenson, O., & Adey, C. (2013). Young children engaging with technologies at home: The influence of family context. *Journal of Early Childhood Research*, *11*(2), 149-164. doi:10.1177/1476718X12466215

Suthers, L. (2004). Music experiences for toddlers in day care centre. *Australian Journal of Early Childhood, 29*(4), 45–49.

Toca Boca AB (2013). Toca Band (Version 1.0.4) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/toca-band/id521640648?mt=8

Touch Media Productions (2010). Percussive (Version 1.05) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/percussive/id375170589?mt=8

Trainor, L. J. (1996). Infant preferences for infant-directed versus non-infant directed playsongs and lullabies. *Infant Behavior and Development*, *19*, 83-92. doi:10.1016/S0163-6383(96)90046-6

Valerio, W. H., Reynolds, A. M., Bolton, B. M., Taggart, C. C., & Gordon, E.E. (1998). *Music play: The early childhood music curriculum guide for parents, teachers, and caregivers.* Chicago: GIA.

Van Scoter, J., Ellis, D., & J. Railsback. (2001). *Technology in early childhood education: Finding the balance.* Portland, OR: Northwest Regional Educational Laboratory. www.netc.org/earlyconnections/byrequest.pdf

Velez, K. N., (2011). Tonal patterns: Providing the vocabulary for comprehensive vocal improvisation. In S. L. Burton & C. C. Taggart (Eds.), *Learning from young children: Research in early childhood music* (pp. 141-158). Lanham, MD: Rowman & Littlefield Education.

Wainwright, D.K., & D.L. Linebarger. (2006). *Ready to learn: Literature review. Part 1: Elements of effective educational TV*. Philadelphia, PA: Annenberg School for Communication, University of Pennsylvania; American Institutes for Research. Retrieved from http://pbskids.org/read/files/BOB- PARTI-ElementsofSuccessfulEdTV.PDF

Weber, D. S., & Singer, D. G. (2004). The media habits of infants and toddlers: Findings from a parent survey. *Zero to three, 25*(1), 30-36.

YogiPlay (2011). Juno's Piano [Mobile application software]. Retrieved from http://www.yogiplay.com/main/junos-piano/

Zimmerman, F.J., Christakis, D.A., & Meltzoff, A.N. (2007). Associations between media viewing and language development in children under age 2 years. *Journal of Pediatrics, 151*(4): 364–368.

Zimmerman, F. J., Glew, G. M., Christakis, D. A., & Katon, W. (2005). Early cognitive stimulation, emotional support, and television watching as predictors of subsequent bullying among grade-school children. *Archives of Pediatrics and Adolescent Medicine, 159*(4), 384-388.

Appendix A

CITI COLLABORATIVE INSTITUTE TRAINING INITIATIVE

CITI Collaborative Institutional Training Initiative

Course In The Protection Human Subjects Curriculum Completion Report
Printed on 4/17/2013

Learner: Aimee Pearsall (username: Aimee85)
Institution: University of Delaware
Contact Information Phone: 814-441-3237
Email: Aimee@udel.edu
UNDERGRADUATE STUDENTS:

Stage 1. Basic Course Passed on 04/15/13 (Ref # 10140944)

Required Modules	Date Completed	Score
Belmont Report and CITI Course Introduction	04/10/13	3/3 (100%)
Students in Research	04/10/13	8/10 (80%)
History and Ethical Principles - SBR	04/10/13	5/5 (100%)
Defining Research with Human Subjects - SBR	04/10/13	5/5 (100%)
Informed Consent - SBR	04/15/13	5/5 (100%)
Privacy and Confidentiality - SBR	04/15/13	5/5 (100%)
University of Delaware	04/15/13	4/5 (80%)

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Return

Appendix B

IRB APPROVAL

RESEARCH OFFICE

210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE: May 16, 2013

TO: Suzanne Burton, Ph.D., M.M., B.A., A.A.
FROM: University of Delaware IRB

STUDY TITLE: [456156-1] Young Children's Preferences for Musical i Pad Apps

SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: May 16, 2013
EXPIRATION DATE: May 15, 2014
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # *6, 7*

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Jody-Lynn Berg at (302) 831-1119 or jlberg@udel.edu. Please include your study title and reference number in all correspondence with this office.