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The impact of digital and physical play on early childhood development

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The Impact of Digital and Physical Play on Early Childhood Development

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Abstract

This study explored the impact of technology on the play development of young children. Seven families with children between the ages of 18 and 36 months of age participated in the study. Four of the children were from homes that did not allow their children to handle and play with electronic devices, and three of the children from were from home that did allow such play. A brief developmental questionnaire was used to categorize the technology status of the home. The data collection consisted of 30-minute video recordings of each child playing with real objects followed by play with that used digital apps with the same objects. The video recordings were analyzed for pragmatic aspects of social interaction, attention, and interest. These were compared for children from low-technology versus high-technology homes. There were no differences in between the two sets of children during play with real object; however, differences were found with playing with the digital apps. Children from low-technological homes showed less interest in playing with digital apps and were more interested in the on-off function of the iPad. Children from high-technological homes remained social in both play conditions but were more independent and explored more during digital play.

Keywords: Play, child development, technology

The Impact of Digital and Physical Play on Early Childhood Development

In the last decade or so, technology has become a large part of our culture, and it is being introduced to children at earlier and earlier ages. While technology has served our culture in a positive aspect in numerous ways, research is beginning to show that technology's effect on the development of young children is not entirely positive. "Technology" can be a term broadly conceived, but the specific technology being referred to for purposes of this research project is that which makes an effort to cater to toddlers and children, such as television, video games, portable video games, iPods, and iPhone apps. With the rapid increase of technology in our world, it is important to understand the effects that technology really is having on our lives, but especially on the development of young children.

Technology is everywhere. We see it in classroom settings, in homes, and in public places. It is more frequently becoming used in speech therapy with children. For example, a study done by Flores and colleagues (2012) compared usage of the Apple iPad to using traditional picture cards when working to improve communication and social skills in children with disabilities. Jonsson, Kristoffersson, Ferm, and Thunberg (2011) evaluated parents' use of the "ComAlong Board" which was designed to aid in communication development with children. These examples are a few that represent many examples illustrating that technology can be useful and purposeful in the teaching and development of children. The purpose of this study is to explore the impact of technology on the play development of young children.

Review of the Literature

This review of literature defines and explores play as a developmental stage. Research that has investigated play by exploring object use as well as emerging research on digital play is included in this review.

Play and Its Role in Development

"Play" is defined by Merriam-Webster's online dictionary as "[engaging] in sport or recreation; frolic[ing]." ("Play," 2013). There is no shortage of studies that attest to the vitality of children playing and the importance of said activity to their normal development. As reported by the American Academy of Pediatrics website, The United Nations High Commission for Human Rights has determined play to be such a contributing factor to normal child development that they have declared it to be a right of every child (Ginsburg, 2007).

Play has been an important topic for researchers in the area of early childhood development. Piaget (1962) established play as a necessary developmental activity. At the time of his writings, play focused on objects and manipulation of those objects. More recently, Smith (2013) explored the underpinnings of digital representations to the development of young children and their play. Her conclusions were that when a child is able to recognize an object, they are able to begin forming an internal representation of these objects composed of geometric shapes. This helps a child begin to engage in pretend play, which is when the child uses an object to represent another object. Consistent with Piaget and other developmental researchers, Smith suggested that even if the early manipulation of objects is digital, of the pretend play that follows is an important marker of future language development in a child. Therefore, if a child cannot recognize objects, they are less likely to engage in pretend play, which means that they are at higher risk of experiencing developmental language differences (Smith, 2013).

Madray and Catalano (2010) wrote a review for the Curriculum Materials Center (CMC) that summarized research that establishes the vital link between play and learning. Using this as a base, they then focused on providing teachers with ideas to help incorporate play into teach across a multitude of subjects. They reported that games and other playful materials are among the

most popular types of learning methods with students. When children engage in these playful resources, especially children around school-age, they are shaping their "conscious or unconscious development of motor skills, social, self-help, cognitive, problem-solving, leadership, [and] multi-skill building" (p. 12) for a wide array of school subjects. Play suggested by Madray and Catalano was both technological, i.e., using a computer game like "Math and the Cosmos" to improve math skills for older students, and low-technological, i.e., utilizing familiar games such as Monopoly or Candyland to develop basic skills in younger students, such as turn-taking, shapes and patterns, and color recognition.

One topic associated with play that Madray and Catalano (2010) addressed was pretend play. This topic has been one of particular interest to researchers since it emerges at particular developmental times and involves symbolic behaviors. In his extensive study of the everyday lives of young children across cultures, Tudge (2008) found that while objects and places associated with play may vary, all children play and within this play, pretend. Griffin's (1984) research on pretend play was more focused. She investigated how children when they participate in shared make-believe blend verbal and social skills in the developmental process. Welsch (2008) expanded on the topic of pretend by investigating the ways that young children in the classroom can build on story lines in books in peer play. All of this suggests that for a child, play with real objects be they toys or books used alone or with others is a crucial component for developing both linguistically and socially.

Physical Play

Smith (2013), from the study mentioned above, builds an entire case around the importance of physical play for the healthy development of young children. Smith presents information on toddler development in a lecture given on how babies learn. Her research

presents strong evidence that says that the way babies move determines what they see, and that what they see determines what they will learn. When a 12 month-old child was observed sitting on the floor, playing with an object and examining it from multiple sides, that object is sustained in the child's vision and the child is learning visual object recognition. They are learning how to recognize the object from multiple perspectives, and they are learning how they would recognize that object amongst clutter. According to Smith, holding and looking at a physical object from multiple perspectives is absolutely critical to normal development in a child. Sitting leads to holding an object that leads to seeing the object and in turn leads to learning about the object.

A study done by Karnik and Tudge (2010) explores play not only in a physical playing with objects but with pretend play and its benefits on children. They state that cognitively, "pretend play has been linked to creativity, academic competence/achievement, linguistic competence, mathematical skills, problem-solving skills, and organizational skills" (p. 63-64). They go on to state that play can improve turn-taking, perspective taking, and peer relations. Perhaps the most important fact to note from Karnik and Tudge's study in regards to this paper is the fact that children did play often but were less likely to pretend play when technology was present. The children in their study played most with toys. The next most frequent activity was watching TV followed by playing with adults. The results showed that "although children were observed playing in about 44% to 63% of the observations, they only engaged in pretend play about 4% of the time" (p. 75) which, according to these researchers, is a significantly lower amount when compared to results of previous studies on pretend play. That difference, however, could very well be attributed to the fact that previous studies on pretend play have been conducted in laboratory settings and pretend play has been induced. In Tudge and Karnik's study the children were observed in their own homes, in their natural environments, in hopes of

observing pretend-play in real-life settings. Another point is that the children in Tudge and Karnik's study were all three years olds, and therefore, did not participate in pretend-play as much as if they were even a year older. However, if what Smith (2013) presented in her findings are accurate, pretend-play is a significant component in aiding children's language development, and Karnik and Tudge's study show that children were watching television more than they were engaging in pretend-play. This study was conducted in 2010, and according to Dervin (2013), when looking at studies regarding media content consumed by a child, “these studies date so quickly that one can confidently add a few percentage points per year to maintain accuracy” (p. 285).

Digital Play

Dervin (2013) has written about how children are being introduced to more and more screen time at earlier and earlier ages. As a result of this, children have higher blood pressure, a lack of vitamin D, increased obesity rates, and a higher likelihood of attention deficits, among other serious issues. He argues that “despite today’s enlightened pediatrics, children’s lives notably in the West are becoming ever more immobile with ever less exercise, less outdoor play, less human contact, less healthy diets, all being triggered by the magnetizing allure of electronic media” (p. 286). An alarming statistic that was part of Dervin’s background research referenced a 2009 study done among children whose ages ranged from 2-24 months. The findings showed that children in this age bracket who “simply [had] a TV set in their rooms meant that children heard 770 fewer words from adults per hour” (p. 285). This led to Dervin creating the phrase, “turn on the TV, switch off the baby” (p. 285-286).

It is work such as Dervin’s as well as the proliferation of new ‘smart devices’ that may be bringing concerns about technology and child development to the forefront in American society.

Children are seen in public using smart phones to remain quiet where they were once given pacifiers or candies. Applications for everything from Peek-a-Boo to finding lost treasure bring entertainment to children on mobile devices that free parents from interaction while shopping, eating, and going about daily life. It is no wonder that Dervin (2013) when looking at studies regarding the media content consumed by a child had to indicate the rapidity of changing data. When reporting on children's use of technology it seems likely that today's results may be tomorrow's history.

Summary and Questions of the Study

Evidence from these articles suggests that playing is imperative for children's development and their learning. Play, both physical and digital, was examined and it can be seen that authors and researchers consistently link play, especially physical play begun at a young age, to healthy development. Specifically, when a child is young, it is crucial that the child is holding objects and being able to examine them from multiple sides, allowing them begin to develop internal representations of objects. The increase in digital objects is a part of modern culture. The impact of early digital manipulation on a child's normal development - linguistic, mental and social is just now emerging. This study seeks to add to this literature. The specific questions of this study are as follows.

1. Do children play differently if the toy is a technological toy versus a physical toy?
2. Is time and duration of play with each toy the same for physical (low-technological) versus nonphysical (technological) toys?
3. Do the children involve others in their play as this varied between real and digital toys?
4. What is the quality and amount of talk during play with the two kinds of toys?

Methodology

Participants

Eight children between 15 and 36 months of age with no known developmental differences were sought for this study. The goal was to include four children in the study from homes that identified their environment as "technological" (e.g., parents allow their child to handle and play with electronic stimuli) and four from homes that identified themselves as "non-technological," meaning, parents monitor their child's intake of technology and in general do not let the child play with electronic devices. The actual participants in the study will be descripted in the results section of the paper under the heading of demographics.

Materials

Materials for this study included an iPad with the Fisher Price "Little People Apptivity Barnyard" app downloaded onto it, and the Fisher Price "Little People Apptivity Barnyard," which were used in brief developmental and play free time. The only other materials used were a brief questionnaire (see Appendix A) for the parent or guardian, and a JVC Everio video camera used to record the play session for analysis.

Procedures

Families with children between 15-36 months of age were sought through nomination for this study. The study was explained to each family willing to participate. Information was compiled via developmental questionnaire regarding the child's play at home. Children were each shown the physical toys first, and given 10-15 minutes to play with the toys provided. The researcher sat on the floor and brought out the toys, then allowed the child to lead and engage in play however they wished. After the elapsed time, the iPad was switched on, and the children were then allowed to engage with the iPad for the next 10-15 minutes. The entire session was

recorded so that it could be analyzed later. Each family/child was seen individually in their homes (with the exception of one child, who was seen on the University campus). The only people who were present were the parent, the child, and the researcher.

Analysis

Analysis of the data began with the first participant and was on-going throughout the study. The video recordings were viewed and analyzed for the total number of words and total different words used by each child across the play segments, i.e. with digital and physical objects. In addition, the time spent with each toy and whether the toy was technological and low-technological was documented. Lastly, speech act coding was used to document the child's interactions with the parent(s) and researcher.

Results

Demographics

Data collection took place during seven individual 30-minute sessions. The families were all from the northwest Arkansas area and can be described as middle-class, Caucasian, and English-speaking. Each child was assigned a code number, and for presentation purposes a 'fake' name. A parent in each family filled out a questionnaire that gave background information concerning the child's technology use and developmental history. The category that these children fell into was based initially upon the recommendation of others who knew the families. Ultimately the categorization fell to the discretion of the parent(s) based upon whether they believed that they enforced restrictions and on the researcher after reviewing the study questionnaire (see Appendix A).

Three children were observed from homes that were high-tech, where parents allow their child to handle and play with electronic stimuli, and four children were observed from homes

that are low-tech, meaning that parents monitor their child's intake of technology and in general limit the child's play with electronic devices. In addition to what was available in the home, a tally of the number of items used across eight modalities listed on the questionnaire (see Appendix A) and how often children used them was completed to categorize the children's technology background. These included: smart phone, tablet, desktop computer/laptop, gaming consul, handheld gaming device, television, video camera, and still camera. Children characterized as "low-tech" by parents and the researcher spent between 1 and 8 hours a week engaging with various modalities of technology. Children characterized as 'high-tech' by parents and the researcher spent between 5 and 16 hours a week engaging with technology.

Of the four children categorized as low-tech, three were male ages 29 months, 29 months, and 26 months. The one female participant was age 27 months. Their code names for reporting results are, respectively, Larry, Leo, Lenny, and Lexi. All but Leo had one other sibling. The age of these siblings were 5 months, 4 months, and 32 months, respectively. In the low-tech category, the average technology use between the four children was 6.75 hours a week. However, the only four modalities available in the home or engaged in by the children were smart phones, television, tablets, and a laptop/desktop computer. Respectively, the children spent 7 hours, 9 hours, 1 hour, and 1 hour a week engaged with technology.

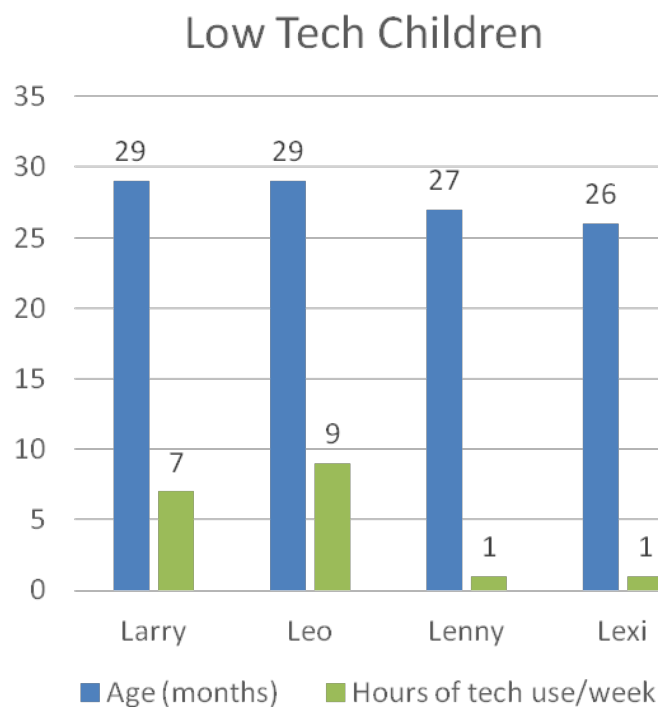
Three children were categorized as high-tech. Two participants were male, ages 22 months and 30 months, and one was female, age 20 months. Their corresponding coding names were Tommy, Tony, and Tara. Tommy was the only participant in this category who had a sibling. This sibling was 38 months of age. The same eight modalities were coded for the high-tech children, and the same four modalities were recorded to be the engaged with: smartphone, tablet, laptop/desktop computer, and television. The average technology use for these children

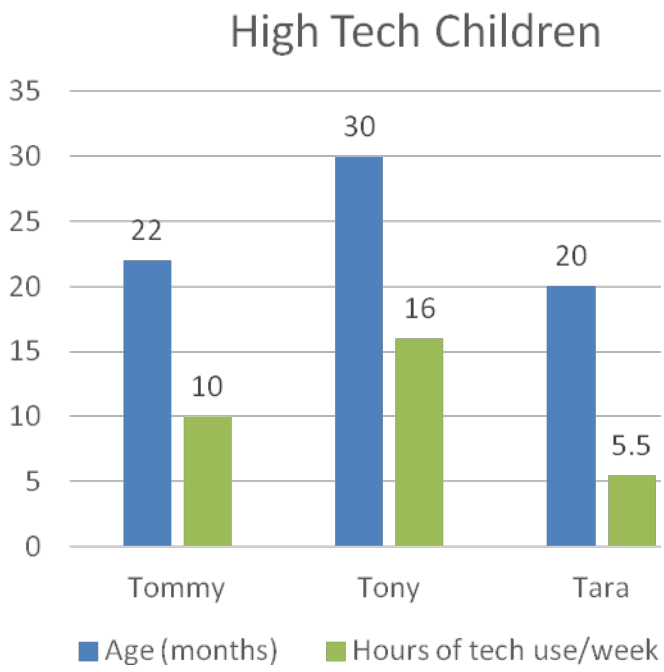
was 10.5 hours a week – respectively, the children spent 10 hours, 16 hours, and 5.5 hours with technology per week.

The graphs below display each child and their use of time spent with technology based on the questionnaire results:

Graph 1

Ages and Technology use for Low-Tech Children and High-Tech Children





Description of Data Collection

Data collection for six participants took place in the participants' homes, with one or more parent present. Data collection for one child took place on the University of Arkansas campus, with the child's parent present. Each session was filmed using a video camera so that it could be further analyzed. The physical play data was collected using the Fisher-Price® Little People® Apptivity™ Barnyard. In the base of the play-set was an iPad with the "Little People® Barnyard" app previously downloaded, but it was left turned off for this duration of time. Objects included with the play-set were brought out one at a time and shown to the child, and then the child and the researcher engaged in play. Data collection began when the researcher started removing the toys from the bag. Children were not encouraged, but were permitted, to incorporate their own toys into the play session. After 15 minutes of engaging in play, the iPad in the base of the toy was switched on, and the "Little People® Barnyard" application was engaged. From there, the child was able to interact with the app and iPad however they chose.

Technological play continued for 15 minutes, and then the data was coded to answer the questions of the study. If the child became disinterested at some point and left the play session without intent of returning, data collection ceased and that session did not total 30 minutes.

Coding

All data was coded using Dore's Primitive Speech Acts (Dore, 1975). His original categories were: greeting, calling requesting an action, requesting an object, answering, labeling, protesting, and imitating. The speech acts were organized into four categories: child's speech acts in physical play, researcher's speech acts in physical play, child's speech acts in technological play, and researcher's speech acts in technological play. It was also noted, in both physical and technological play, if these speech acts occurred while engaging in pretend play. Speech acts were further distinguished as verbalizations, vocalizations, or non-verbal communication (see Appendix B).

Question One

The first question of this study asked if children play differently if the toy is a technological toy versus a physical toy. To determine this, the number of different activities within each segment of play was counted, as well as the number of times the child switched activities (repeating activities fell in this tally; i.e., child plays with the cow, then the rake, then the cow again would equate to 3 activity switches).

Of the four low-tech children, three of the four participated in a greater number of activities and activity switches while engaging in technological play. Leo engaged in more activities and activity switches while playing with physical toys. Of the three high-tech children, each child engaged in a greater number of activities and activity switches while playing with physical toys than while playing with the iPad.

Question Two

The second question of this study asked if the time and duration of play with each toy was the same for physical (low-technological) versus nonphysical (technological) toys. This was determined by recording the amount of time spent with kind of toy, physical or technological, and also by recording the amount of time spent with each toy activity (time spent playing with the cow, time spent feeding the animals, etc.).

The four low-tech children spent an average time of 14:20 playing with the physical toys, and an average time of 13:42 playing with the digital toys. Twenty-one different activities were engaged in between the four children during physical play, and seventeen different activities were engaged in during digital play.

The three high-tech children spent an average time of 14:24 playing with the physical toys, and an average time of 11:11 playing with the digital toys. Twenty-two different activities were engaged in between the three children during physical play, and seventeen different activities were engaged in during digital play.

Question Three

The third question of this study asked if the children involve others in their play as this varied between real and digital toys. This was evaluated by determined by recording the time that the child spent playing alone, and the time that the child spent engaging the researcher in their activity. Time qualified as engaging the researcher if the child referenced the researcher while playing, either through verbalizations, vocalizations, or nonverbal communication. Time qualified as playing alone if the child was clearly not including the researcher in his or her play activity, i.e., if the researcher was engaging in a toy activity but the child was separately engaged in their own toy activity play.

The four low-tech children, when engaged in physical play, spent an average time of 1:46 playing alone and 13:52 engaging with the researcher. When engaged in digital play, they averaged a time of 3:09 spent alone and 10:14 playing with the researcher.

The three high-tech children, when engaged in physical play spent an average time 2:51 playing alone and 12:31 engaging the researcher in their play. During digital play, time spent alone was 2:41 and time spent engaging the researcher in play was 9:32.

Question 4

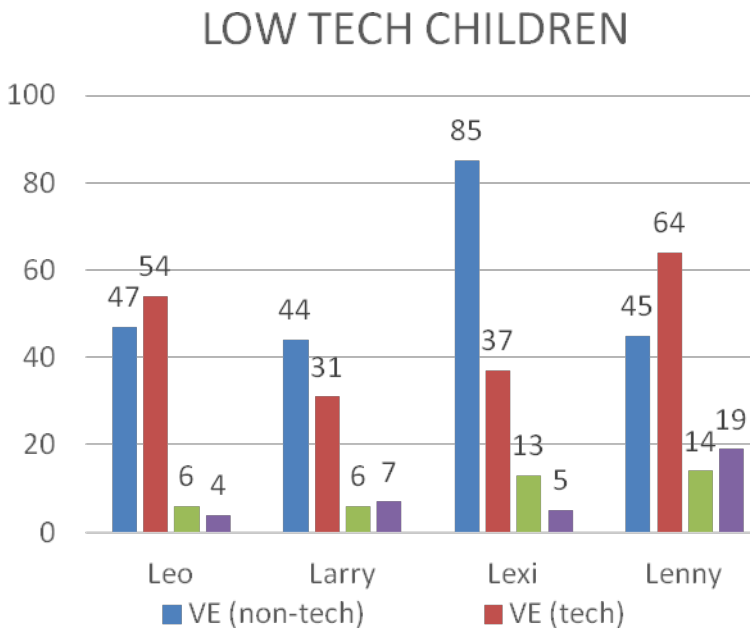
The final question explored in this study asked what the quality and amount of talk was during the play with the two kinds of toys. The number of verbalizations (words, sentences, phrases) and vocalizations (sounds with meaning) were tallied during each form of play to answer this question.

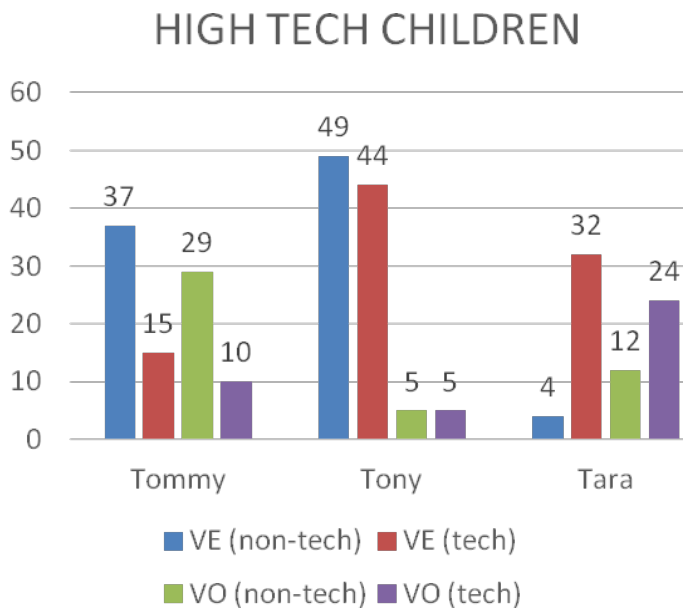
Of the low-tech children, Lenny used more verbalizations and more vocalizations while using the iPad than while playing with physical toys. The other three children in this category all used more verbalizations while playing with physical toys and two of the same three used more vocalizations in physical play than in digital play.

Of the three high-tech children, each child used more verbalizations when playing with physical toys than with the iPad. Two of the children used more vocalizations while engaging in play with the physical toys than with the iPad, and the third child used the same amount of vocalizations during both forms of play. The graph below illustrates this:

Graph 2

Communication when playing with Real and Digital Toys for Low- and High Tech Children





Discussion

This study explored the impact of technology on the play development of young children. The results of this research found there were no differences between low-and high-tech children during play with real object; however, differences were found with playing with the digital apps. Children from low-technological homes showed less interest is playing with digital apps and were more interested in the on-off function of the iPad. Children from high-technological homes remained social in both play conditions but were more independent and explored more during digital play.

Since it is crucial for children, especially young children, to learn through touch and manipulation as well as through repetition, it seems vitally important to try to understand how the growth of the technological especially for children impacts language acquisition and expression. The AAP (American Academy of Pediatrics) strongly discourages parents from letting their children under the age of two watch any television at all; after the age of two, it is unknown whether exposure to media contributes to communication and social deficits (Council on Communications and Media, 2013). In the aforementioned study done by Ginsberg (2007), it was stated that playtime is crucial for children even if it is unstructured. Unstructured playtime gives children the chance to solve problems on their own and stimulate their creativity.

While this study involved a limited number of children and families, it does provide a snapshot of the population of two-year olds who are being raised in an American technology-saturated culture. The information gained suggests that there is a range of technology use in homes and that parents have deep feeling about what is appropriate for their children. The recognition of this is important for the understanding of how this shift into technology in our daily environments is effecting the development of the next generation of children.

Researchers have only begun to scratch the surface of how living and learning in a technologically-enhanced world will impact development. The world becomes a different place in which to live when it is possible for everything from doors to lighting to chairs to digitally 'talk' to each other. Therefore, it would not be surprising if infants and young children born into this world begin to play seamlessly with real and digitally enhanced items. What remains unknown is how such large scale technology exposure will impact the play of young children and other development as they continue to grow into school-age children and eventually into working adults. This research is a contribution to this literature that is just emerging.

Limitations

There are several factors that limit the generalization of the results of this study. Firstly, the parameters for what constitutes a low- versus high-tech families. As the study progressed it became clear that the destination between environmental technology and parental use of technology was not captured by the study's questionnaire. There may be gender differences in how young children adapt to technological interfaces. This notion was not part of the conceptualization of this study, however, as the both male and female children with varying experience with technology emerged, it cannot be determined if there would have been gender differences. Lastly, this study did not control for older sibling. While most of the children in this study did not have an older sibling, those that did had a different interactional pattern when that sibling was the other during play. Therefore, the impact of siblings on play development could not be addressed by this study.

Future Directions

This study forms a foundation for the study of technology in play for young children. An important next step will be to continue data collection so equal numbers of children at each age

level and technological status can be compared. The results of this expanded study would add much needed developmental information to the emerging data pool. Additional research might focus on the technological needs and uses of this for children who have special needs. This kind of study would build on this baseline normal development study.

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Appendix A

Developmental Questionnaire

1. How old is your child? _____Date of Birth_____ [ ] Male [ ] Female
2. Is your child meeting expected developmental milestones?
3. Are there other children in the family, if so, what are their ages? _____
4. List three of your child's favorite activities.
   1)
   2)
   3)
5. Does your child attend day care or a preschool program? [ ] yes [ ] no
6. If they attend one of these, is technology used there? [ ] yes [ ] no
7. Please fill out the following table on technology use in your home:

OBJECT(S)	WHERE IN THE HOME IS/ARE THE OBJECT(S) USED?	HOW OFTEN IS/ARE THE OBJECT(S) USED BY THE FAMILY? (HOURS/WEEK)	HOW OFTEN IS/ARE THE OBJECT(S) USED BY THE CHILD? (HOURS/WEEK)
SMART PHONE (IPHONE, DROID, ECT.)			
TABLET (IPAD, KINDLE, SAMSUNG GALAXY, ECT.)			
DESKTOP COMPUTER/ LAPTOP			
GAMING CONSUL (WII, XBOX, ECT.)			
HANDHELD GAMING DEVICES (GAMEBOY, PS2, ECT.)			
TELEVISION			
VIDEO CAMERA			
STILL CAMERA			

8. Is there any other information that you would like to give me about your child and his or her play and/or development? (Flip sheet over if necessary)

Appendix B

PSA Coding Sheet

Case:_____Age in months:_____ [ ] Low Tech [ ] High Tech

Child: Physical Toys

Dore's Primitive Speech Acts				
The Act	Ve	NV	Vo	
Greeting				
Calling				
Requesting an action				
Requesting an answer				
Answering				
Labeling				
Protesting				
Imitation				

Researcher

Dore's Primitive Speech Acts				
The Act	Ve	NV	Vo	
Greeting				
Calling				
Requesting an action				
Requesting an answer				
Answering				
Labeling				
Protesting				
Imitation				

Child: Tech Toys

Dore's Primitive Speech Acts				
The Act	Ve	NV	Vo	
Greeting				
Calling				
Requesting an action				
Requesting an answer				
Answering				
Labeling				
Protesting				
Imitation				

Researcher

Dore's Primitive Speech Acts				
The Act	Ve	NV	Vo	
Greeting				
Calling				
Requesting an action				
Requesting an answer				
Answering				
Labeling				
Protesting				
Imitation				

Appendix C

February 11, 2014

MEMORANDUM

TO: Hannah Smith
Fran Hagstrom

FROM: Ro Windwalker
IRB Coordinator

RE: PROJECT MODIFICATION

IRB Protocol #: 13-10-158

Protocol Title: The Impact of Digital and Physical Play on Early Childhood Development

Review Type: 0 EXEMPT 1 EXPEDITED 0 FULL IRB

Approved Project Period: Start Date: 02/10/2014 Expiration Date: 10/17/2014

Your request to modify the referenced protocol has been approved by the IRB. This protocol is currently approved for 48 total participants. If you wish to make any further modifications in the approved protocol, including enrolling more than this number, you must seek approval prior to implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

Please note that this approval does not extend the Approved Project Period. Should you wish to extend your project beyond the current expiration date, you must submit a request for continuation using the UAF IRB form "Continuing Review for IRB Approved Projects." The request should be sent to the IRB Coordinator, 210 Administration.

For protocols requiring FULL IRB review, please submit your request at least one month prior to the current expiration date. (High-risk protocols may require even more time for approval.) For protocols requiring an EXPEDITED or EXEMPT review, submit your request at least two weeks prior to the current expiration date. Failure to obtain approval for a continuation on or prior to the currently approved expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.