UNLOCKING THE TABLET: PARASOCIAL INTERACTIONS AND SCAFFOLDING FOUND IN INTERACTIVE MOBILE GAMES

by

Chelsie Akers

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF COMMUNICATION

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

2017

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Dissertation Committee, we certify that we have read the dissertation prepared by Chelsie Akers titled Unlocking the Tablet: Parasocial Interactions and Scaffolding Found in Educational Mobile Game Apps and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

_____ Date: (07/21/2017)
Steve Rains

_____ Date: (07/21/2017)
Jennifer Stevens Aubrey

_____ Date: (07/21/2017)
Matthew Lapierre

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copies of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

_____ Date: (07/21/2017)
Dissertation Director: Steve Rains

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of the requirements for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that an accurate acknowledgement of the source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Chelsie Akers

Table of Contents

List of Tables

Abstract

The present study examined whether the exposure to likeable characters and educational content would affect the attitudes and behaviors of children after playing an educational children's game. The parasocial interaction (PSI) experienced by children was measured between children playing an educational game with interactive characters and those children who watched videos with the same character. This study also investigated the presence of mediated scaffolding provided by the interactive character in the educational game.

A three group between subjects experimental design was employed. Subjects were randomly assigned to play an educational game, watch a video, or color on a tablet for 10 minutes. They were asked a series of questions about their experience on the tablet and the interaction with the character and then offered an educational prize or non-educational prize at the end.

This study found that children in both the educational game and video condition reported experiencing a PSI with the character Alpha-Pig. Additionally, it was found that when kindergarteners were exposed to the educational game and the educational video, they chose an educational reward more often than the control group. This study also found that with this particular age group and the use of tablets, there were many findings that were impacted by a ceiling effect: children in all groups scored high on the educational worksheet and showed high levels of motivation for current and future learning.

These findings support past PSI research, showing that children are experiencing a PSI while interacting with a likeable character in an educational game. Additionally, this study adds to the understanding of scaffolding, extending its effects from only personal interactions to

mediated interactions. Ultimately, this study helps parents and teachers to understand the importance of likeable characters in educational games for children.

Unlocking the Tablet: Parasocial Interactions and Scaffolding Found in Interactive Educational Games

Introduction

Children today are experiencing media differently than they have in the past. The number of homes with tablets has now reached 80%, and screen time devoted to tablets is nearly an hour a day (Common Sense Media, 2015). Interactive media are media that prompt the user to engage or respond to the program; this can be found most often on a computer or mobile device (NAEYC & Fred Rogers, 2012). With the increase in tablet ownership and screen time devoted to mobile devices, it has become imperative to focus research on understanding media effects via mobile devices for children. While more research would be welcome across areas related to children and new technologies, one particular aspect in need of further study is that of potential effects of educational interactive media available to children.

A common tool used in both traditional and interactive educational media is that of characters. Television shows such as *Blue's Clues, Dora the Explorer,* and *Sesame Street* all include likeable characters from whom children learn. It has been found that children watching television shows with likeable characters have scored higher in areas such as: school readiness, executive functioning, Spanish vocabulary, cognitive development, creativity, and imagination (Anderson et al., 2001; Anderson et al., 2000; Barr, Lauricella, Zack, & Calvert, 2010; Fisch, Truglio, & Cole, 1999; Lauricella, Barr, & Calvert, 2009; Linebarger & Walker, 2005; Piotrowski, Vossen, & Valkenburg, 2015). On the other hand, there is little research looking at effects of interactive media on educational outcomes. Most research done on the topic has been conducted through organizations such as PBS and Age of Learning, Inc. More research needs to be carried out to further understand the learning potential behind educational interactive media.

There are three goals of this dissertation. The first is to identify the degree to which children are able to experience parasocial interaction while playing an educational game with a character. Parasocial interaction (PSI) is the interaction between a character and the audience, wherein the user feels as if they are part of a two-way interaction when in fact, they are only experiencing a one-way interaction (Horton & Wohl, 1956). The second goal is to distinguish if children's attitudes and behaviors can be affected through playing educational children's games with characters whom they have experienced a PSI. Attitudes will be assessed to see if a child will show more motivation toward educational activities, and behavior will be assessed by measuring if a child will choose an educational reward. And the third goal is to discover if children can learn more when playing educational games through the character's ability to engage in scaffolding with the child. Scaffolding is when a child is being assisted in the learning process by an adult or advanced peer who is able to push the child to achieve a difficult task or problem that would not have been possible alone (Vygotsky, 1980; Wood, Bruner, & Ross, 1976). In this project, it will be tested if likeable characters can act as the advanced other in the context of an educational game and support the child in learning from the game.

Literature Review

Educational television has been a part of American society and mass media research for more than 45 years (Anderson et al., 2001; Fisch, Truglio, & Cole, 1999). According to the Federal Communications Commission (FCC), educational television is defined as "programming that furthers the positive development of children 16 years of age and under in any respect, including the child's intellectual/cognitive or social/emotional needs" (FCC, 1996, p. 14). Specifically, the content of the program must have education as the significant purpose of the show and the educational purpose and specific target audience are written in each station's

programming report for children (Kunkel, 1998). Because of its popularity, educational television has become a topic dense with theories, constructs, and frameworks for understanding children's developmental learning effects from educational content.

Research on educational shows has uncovered specific strategies and elements that are used to make a show educational. Some learning strategies used in educational shows consist of showing a supportive literacy environment, as well as supporting comprehension and vocabulary (Linebarger & Piotrowski, 2010). Linebarger and Vaala (2010) found that three elements that influence children's learning potential: when the media resembles the child's real life, when the educational element is repeated, and when it is co-viewed with a more advanced other. Different strategies can be seen in educational shows using narrative (emotional) or expository (information-based) story telling. It was found that narrative stories resulted in higher vocabulary and comprehension scores for children. And, expository shows gave children higher inferential comprehension (Linebarger & Piotrowski, 2010).

Characters such as human-sized dinosaurs, larger-than-life dogs, and colorful puppets are often used in children's shows (Cook, 2014). These characters are used to appeal to children and to teach them the educational topics of the show (Kirkorian, Wartella, & Anderson, 2008). Many specific shows have been studied for the effects of their educational content, yet the content is intertwined with the character's influence. Beyond character presence, a number of shows have started including quasi-interactive characters using participatory cues as the children watch (Piotrowski, 2014). Participatory cues are used by the character directly addressing the audience and then time is given for the audience to answer. One of these shows, *Blue's Clues*, was found to have a positive influence on children's learning outcomes (Anderson et al., 2000). Additionally, greater vocabulary and higher expressive language was found in children who

watched *Blue's Clues* along with similar shows such as: *Dora the Explorer*, *Arthur*, *Clifford*, and *Dragon Tales* (Linebarger & Walker, 2005). Research has shown that the character itself plays a role in the learning process (Gola, Richards, Lauricella, & Calvert, 2013; Lauricella, Gola, & Calvert, 2011). Children engage with the character in the show and thus learn from the character. Ultimately, characters are a key in the learning process as children view educational content because characters increase the potential for learning from educational content.

Interactive Media

Due to the changing landscape of media, educational content is now available through learning applications (apps) as interactive media. Interactive media are media that "allow for contingent responses to children's actions" (Radesky, Schumacher, & Zuckerman, 2015). In other words, the user is an active participant in which the game is directly reactive to the response of the user so the child will experience successes or failures in direct response to their given behavioral choices (Calvert, 2009; Wartella, O'Keefe, & Scantlin, 2000). Learning effects such as school readiness, increased vocabulary, and reading comprehension have been found in educational television (Anderson, 2003; Barr et al., 2010; Calvert & Kotler, 2003; Linebarger & Pitrowski, 2010; Linebarger & Walker, 2005; Piotrowski et al., 2015). However, educational content on an interactive device is fundamentally a different experience for children, so the understanding of television's educational nature is only a starting point for interactive media's new line of research. But, as media consumption shifts from solely educational television to educational interactive media, more research needs to explore interactive media and the potential for learning effects. Interactive media are important to study because many physical and cognitive elements stemming from the technology are unknown.

Few studies have been done in regards to interactive educational media. Ferri, Gancedo, Lizandra, Segui, and Costa (2013) gave children (8-10 years old) a mobile device of either an iPhone or a tablet, that taught them about the water cycle. They found that children scored significantly higher on a post-test than the pre-test given before engaging with the mobile devices. By using a pre-test/post-test method, this study found that children are able to pick up skills from a mobile game.

Another study by PBSKids found potential for leaning in two PBS mobile games: Martha Speaks and Super Why. *Martha Speaks: Dog Party* (PBS KIDS, 2016) is an example of an educational children's game. This game promotes vocabulary enhancement and is intended for children between 4 and 7 years old. The PBS KIDS (2010) organization researched the effectiveness of this app and the post-test found a 20% increase in children's vocabulary compared to the pre-test (Chiong & Shuler, 2010). Additionally, the game Super Why was found to offer literacy gains between 17% and 8% for 3-6 year olds (Chiong & Shuler, 2010). These two studies by PBSKids are used to show evidence that children can learn from mobile games.

Previous research on educational mobile games has focused on the ability for the game to teach the child. Now that educational games have been found to in fact be educational, research needs to shift and discover what aspects of the game are fostering learning outcomes. With more understanding of the aspects aiding in the learning process, parents and game developers can choose and make games that have the highest potential to foster leaning during game play. The current study aims to identify if two aspects of communication and learning are aiding in the learning process within educational mobile games: PSI and Scaffolding.

Even though there are many unknown aspects and effects of interactive media, the presence of interactive media is still rising in use among American households. Common Sense

Media (CSM, 2013) produced a nationwide survey and found that children are consuming media much differently than they have previously. CSM found that children eight years old and under spend an average of 1 hour and 55 minutes per day consuming screen media. Of that time, 26 minutes is devoted to computers and mobile devices (as of 2013), a 5-minute per day increase from 2011. In fact, from 2011 to 2013 all platforms of screen media use decreased (television, DVDs, computers, and video games) while mobile device usage increased. Part of this is because tablet ownership among families itself has increased. Of homes with children 0-8 years old, 8% owned a tablet in 2011; by 2013 that had increased to 40%. In fact, by the age of four, 64% of children have their own tablet (Kabali et al., 2015). While interactive media (computers and mobile devices) are mainly used by children to play games, these devices are also used for educational content (CSM, 2013). As of 2013, parents reported that of school-aged children five to eight years old, 44% play educational games on a mobile device, and 48% play educational computer games (CSM).

Interactive media are increasingly used for educational content in schools. A simple web search for educational mobile games brings up articles like "5 Apps to Boost Math Skills over the Summer" (Simone, 2014), and "Best Learn-to-Read Apps for Kids" (iVillage, 2014). Another example of the popularity of learning apps is that 72% of the top-selling Apple (iPad and iPhone) applications in 2012 were targeted at toddler and preschool aged children and the most predominant category was that of "general early learning" (Shuler, 2012). However, little research has been done in regards to learning from these apps. More empirical, peer-reviewed academic research needs to be conducted to understand the true learning capabilities of educational apps.

Video Games and Positive Outcomes

In addition to what we know about mobile interactive games, interactive video games also provide evidence of positive outcomes from engagement with interactive media. These findings help to guide the understanding of how interactive media have learning effects on children. Over the past decade, studies have begun to study positive effects from video games (Granic, Lobel, & Engels, 2014). Cognitive skills such as spatial resolution, attention allocation, problem solving, and creativity have been found to be higher for those who play shooter and role-playing type video games (Green & Bavelier, 2012). Positive motivational, emotional, and social benefits have also been found from similar video games (Granic, Lobel, & Engels, 2014).

Not only are positive effects found in average video games, there are some video games that are specifically made to teach educational or prosocial messages. Educational and prosocial games have been found to have positive results when exposed to children. School children score higher in math and reading after playing educational software (Murphy et al., 2002). Similarly, health education video games have improved disease management for adolescents with diabetes (Lieberman, 2001) and higher adherence to treatment protocol for cancer patients (Kato, Cole, Bradlyn, & Pollock, 2008).

For years, educational television shows have been making their way into homes and have been a focus in the academic research agenda. Past research has shown that children can learn academic and prosocial behaviors through educational media especially with the use of characters. This past research is relevant and important because it lays a foundation for the understanding of what educational possibilities are potentially available through educational interactive media. As many positive outcomes have been found when characters are used in educational television, this research will aid the understanding of how characters in educational games will affect children. Additionally, studies finding positive outcomes from video games

provide a foundation for this study by identifying possible learning effects from interactive media. Proceeding research on interactive media will add to and strengthen the current understandings of educational media effects.

The Present Study

With technological advances occurring at a rapid pace, it is important for researchers to discover what role and effects technology plays in the lives of children. As parents and teachers implement tablet use with young children, they are opening doors to researchers. This project aims to identify if an educational game can change a child's attitudes and behaviors toward a subject. Additionally, this project will discover the role a character plays in the learning process within an educational game. To analyze these topics, this project will rely on the media effects concepts of parasocial interaction (PSI; Horton & Wohl, 1956) and the leaning theory of sociocultural theory (Vygotsky, 1980). PSI will be used to address the possible effects caused by the characters used in educational games, such as attitude and behavioral changes based on the interaction with the character. Additionally, sociocultural theory will be used to identify possible learning effects children receive based on the interaction with the character, specifically if the character's presence is acting as scaffolding for the child to advance through the game.

Parasocial Interactions and Relationships

Character presence, participatory cues, and character familiarity have all been shown to have positive learning effects for children watching educational television (Gola, Richards, Lauricella, & Calvert, 2013; Piotrowski, 2014). By having a character present children are able to engage in a PSI and participatory cues adds a quasi-interactive level to the exchange between the character and the child which can influence children's PSI. The children feel as if they are taking part in a two-way interaction similar to an in-person social interaction where there is

interchange between the character and the children, when in fact it is only a one-way interaction. By simulating the appearance of a two-way interaction, the developers of educational media are able to elicit stronger educational effects. This project aims to study the presence of a character used in educational interactive media to test if there are also educational effects found for the children who interact with characters in a more dynamic nature than that of television exposure.

One main tenet of PSI is that media messages do not only affect a person's behaviors but they affect emotions as well. Horton and Wohl (1956) first conceptualized PSI as when the audience gives an anticipated response to a performer. In other words, media consumers view a distant persona through media and have repeated interactions with it ultimately forming a one-sided relationship with the persona (Cohen, 2009). A parasocial interaction is the actual interaction between the viewer, and the persona and the relationship that spawns from continuous interactions is a parasocial relationship (PSR). The persona becomes part of the viewer's life. In other words, the public and private moments of the persona's life are shared with the viewer appearing to be intimate with "literally crowds of strangers" (Horton & Wohl, 1956, p. 216). The viewer will get to a point where they feel as if they know and understand the character. Subsequently, this will lead a viewer to make changes in thoughts, ideas, and behaviors because inevitably any interaction with another person (in this case a media-portrayed person) causes adaptions to be made (Horton & Wohl, 1956).

The present study will be analyzing the PSI that occurs when a child is exposed to a character in a game one time. One component of PSI in traditional media is that the character acknowledges the audience leading the audience to have an appropriate answering role (Horton & Wohl, 1956). For example, in *Dora the Explorer* the character Dora will ask questions to the audience and then the show will pause for a few seconds giving time for the audience to respond.

In other words, the character acted in such a way as to give the child an answering role. This one-time interaction between the child and character is an example of parasocial interaction. The audience engages with the character while exposed to the media.

Another component of PSI is that of content production, which also affects the character/audience relationship. In traditional media, television production techniques used to foster PSI include: character verbally addressing the audience, character looking directly into the camera, character adjusting head and eyes toward camera with dialogue seemingly coming from the mind (mouth not moving, as if audience is mindreading), and ease of audience ability to take the character's perspective (Hartmann & Goldhoorn, 2011). These production components of PSI are evident in mobile game apps as well, and more frequently incorporated than in television shows since the entire game is interactive. There are only a few shows that are interactive, such as: *Sesame Street*, *Blue's Clues*, *Dora the Explorer*. On the other hand, the entire nature of the mobile game app is that it is interactive media. Mobile games are specifically produced to interact in some way; they have characters that look directly at the player and characters or voice-overs address the player individually. One way this technique is incorporated in games is when a character from the game says or text appears saying, "Congratulations, you have reached your new highest score."

Once the audience has been affected by these components, two common outcomes from the PSI are: higher enjoyment of the viewing experience and more commitment to social norms while viewing (Hartmann & Goldhoorn, 2011). Another effect of PSI is that after the initial interaction while exposed to media, it is possible for the viewer to form a parasocial relationship (PSR), which is when the audience is away from immediate exposure and continues to develop the relationship with the character much like that of an in-person social relationship (Eyal &

Dailey, 2012). It has been found that when parents report children playing with toy replicas of characters from the media, are repeatedly exposed to the character, are encouraged by a parent, and have experienced parasocial interactions with the character, the children are more likely to form parasocial relationships (Bond & Calvert, 2014).

Studies have also found educational outcomes as an additional effect when addressing children and parasocial relationships. For instance, children are able to arrange a series of cups by size order when taught how to do so by characters with whom they have a previous PSR with (Lauricella, Gola, & Calvert, 2011) and from characters with whom they feel an emotional closeness (Gola et al., 2013). While children with strong PSRs are better able to learn from a character, this study aims to test if a novel and interactive character can have an educational effect on the child.

One illustration of a production techniques used to facilitate PSI/PSRs in children's mobile game apps is the inclusion of a likeable character who is seen and interacts with the child (i.e. the character looks directly at the child and addresses the child from the mobile device). For example, in the mobile game app Elmo Loves ABCs, Elmo talks to and directs the children during the game ("Apps and e-books", 2015). Children's game developers are not only using licensed characters but also creating new characters specifically for a line of educational games (e.g., ABC Mouse and Lola the Panda).

In the present experiment, children are assigned to one of three conditions. In the first condition, children are assigned to play an educational app on a tablet. In the second condition, the children will watch a segment from an educational video on a tablet. Finally, there is a control condition in which children will not be exposed to educational content or a character.

After these conditions, the children will complete a subsequent educational activity and answer questions about what they did.

Television viewers can experience a PSI when the persona or character on screen looks at the television and talks directly to the audience. In this project, when the child playing is engaged in the game, the character of the educational game looks directly at the player and addresses the player directly. Children can experience a PSI with the character due to the character's close proximity and the character directly talking to the child. However, with the character looking at the audience and engaging with the audience during the entirety of the 10 minutes of game play, children will have stronger parasocial interactions than children who watch the video. Consistent interaction throughout is not the only difference between television's attempt at interaction and interactive games. Additionally, the interactivity offered in games is in direct response to the actions made by the child. When a child takes an action in an interactive game, the character will respond according to the action taken by the child. In a television show, when a child is given a participatory cue, the character will give a response and continue no matter what the child answered. Thus, a true interaction is not taking place holding the child back from having as intense (Hartmann & Goldhoorn, 2011) of a PSI as the child interacting with the character in an interactive game.

Hypothesis 1: Children in the educational game will indicate engaging in a more intense parasocial interaction than children who watched an educational video.

PSI has also been found to lead to behavioral changes when the viewer feels as if they have the self-efficacy to follow through with personal changes in line with the character. When the viewer feels his/her interests are joined with those of the character, and the character prompts referential involvement which is when the viewer feeling as if message relates to him/her

personally, the viewer is more likely to show a behavioral change (Bandura, 2004; Katz, Liebes, & Berko, 1992; Papa, Auwal, & Singhal, 1997; Papa, Singhal, Law, Pant, Sood, Rogers, & Shefner-Rogers, 2000). As children are exposed to a character either through the game or video, the parasocial interaction with the character along with the educational content associated with that character will affect the behavior of the child through referential involvement. The content the character is delivering relates to the child on a personal level because children between five and seven years old are at a stage of life where education and learning are a large part of their lives. It is between the ages of 4 and 7 that children are starting to develop cognitive and emotional skills through trial and error as well as from their surroundings (Piaget, 1964; Vygotsky, 1980). It is particularly important for media scholars to study educational effects in children this age because their development is now incorporating the understanding of technology. By the age of 5, children are able to fully operate mobile devices on their own (Abdul Aziz et al., 2013). Due to this, those children exposed to a character in an educational setting will be prompted to choose an educational reward over a non-educational reward because they will be influenced to mirror not only the character but the combination of the character in the educational setting.

> Hypothesis 2: Children who played the educational game will select an educational reward (activity book) more often than, children who watched the educational video, and children in the control group.

Learning Theories

This project is to examine the effects of a character in educational games. Claims of educational outcomes can often be found in the description of educational games. For example, the description of the educational children's game *Martha Speaks: Dog Party* (PBS KIDS, 2016)

says “this game promotes vocabulary enhancement and is intended for children between 4 and 7 years old.” With these educational claims, it is important to understand how children in this age group learn. The 4-7 year-old range is critical in children’s learning because they are beginning to understand and use symbols which play a role in language development and basic arithmetic (Steinberg, Vandell, & Bornstein, 2011). It is in this stage when many of the milestones for the transition from infant to toddler are acquired; the child can now run, jump, throw, catch, and climb (Vatavu, Cramariuc, & Schipor, 2015). It is during this stage that it becomes important for children to start engaging with problem-solving tasks based on personal levels of development both independently and from their environment. This stage is also important to understanding technology use among young children because the use of mediated devices requires specific motor skills which are developed in this stage (i.e. tap, drag, stroke gestures, and touch terminology; Abdul Aziz et al., 2013; Brewer et al., 2013; McKnight & Fitton, 2010). Constructivism (Piaget, 1964**)** and sociocultural theory (Vygotsky, 1980) are two learning theories which are important for understanding the development of a child between 5 and 7 years old and can be used to understand how children can learn from an interactive game.

Constructivism outlines how children lean on their own through trial and error. Constructivism is a framework used to understand child development and has its roots in Piaget’s work (Piaget, 1964**)**. The basic idea of Piagetian constructivism is that children will learn through experience. Constructivism is a four part psychological process: knowledge is acquired through learning information, using that information to form rules, previously formed rules are disregarded because of new experiences, and repeats when new rules have to be formed (Brooks, 1990). This is a very active process for the child. Constructivism bases the developmental stage of a child on the cognitive development and deep understanding acquired through the active

learner's reorganization of understanding. Piaget has outlined three parts to a child's constructive processing: generating hypotheses, performing experiments, and drawing conclusions. The active child is gaining knowledge much like the scientific method of testing hypotheses (Piaget, 1964**)**. Using this process, children continually make and test new hypotheses in order to gain understanding of their surroundings.

According to constructivism, school-aged children (4-7 years old) are beginning to advance in many skills such as language and imagination. Even though a child younger than four years old may have been exposed to interactive media, many educational games are aimed at the audience of 5 to 7 year olds in order to promote learning (Shuler, 2012). The constructivist approach can be used to measure 5 to 7 year-old children's development in regards to interactive media. First this can be applied to the child's actual use of the device and second applied as the child consumes educational content within interactive media. When a child is first introduced to interactive media, he or she has to learn how to physically use the device. Such aspects include turning on the device, selecting the appropriate content or game, navigating within the content or game, and dealing with interruptions like pop-up ads, force-exits, or incoming calls/texts to the parent. To become proficient with interactive media, the child has to interact, experiment, and renegotiate understanding of the device itself. Concurrently, while developing technical skills, the child is also attempting to learn from the educational content. For example, when playing a math or reading game the child will enact many traditional steps to learning. When faced with flashcards, fill in the blanks, and puzzles the child will pull the information about the task previously stored to attempt the answer. If the child's stored concept is challenged, then the game will prompt experimentation such as trying new letters or rotating puzzle pieces, which leads to new understanding being stored. These two examples are ways in which the

constructivist framework can be applied to children's learning development while using educational interactive media. This process is very similar to the process used with traditional learning tactics. One main difference is that functional and educational concepts are working interchangeably in the trial and error process. Using the puzzle example, a child playing with a physical puzzle will learn through trial and error to rotate a puzzle piece to fit a spot; however, on a mediated device the child will need to learn the need for rotating the piece and then how to operate the device to rotate the piece.

Sociocultural theory focuses on how children learn beyond individual trial and error. Sociocultural theory can explain why learning is possible within interactive games. Sociocultural theory is based in Vygotsky's (1980) work which is founded on the understanding that all learning happens in a sociocultural setting and the setting effects children's learning. Vygotsky acknowledges that people learn individually; however, everything learned is set within a sociocultural context. More specifically, that in order "to understand human thinking and learning, one must examine the context and setting in which that thinking and learning occurs" (Bonk & Cunningham, 1998, p. 35). This theory indicates that learning outcomes occur through direct contact between the child and another person (e.g., parent, caregiver, aunt/uncle, sibling, teacher). The *what* and *how* something is taught depends on the cultural background of the individual teaching it.

When applied to interactive media, sociocultural theory is used to explain learning through co-using a device (Lauricella, Barr, & Calvert, 2009). For example, when parents are present while the child is using the device, they can encourage learning by asking questions, showing examples, and assisting when the child cannot perform the task. There can be many appropriate uses for co-using technology and electronic media in such cases where a digital form

has taken the place of a non-digital interaction. Reading electronic books, viewing digital photos, and video conferencing loved ones are examples of positive uses of mobile devices.

There are two concepts of Vygotsky's sociocultural theory that are particularly important to understanding children's learning from interactive media, specifically the zone of proximal development and scaffolding (Kail, 2012; Vygotsky, 1980). The zone of proximal development concentrates on two specific levels of development. A child has an actual or completed development level, determined by what has been independently learned up to a given point and the child has a level of potential development, which is a level that can be reached but only though the help of others (parents or advanced peers). The zone of proximal development refers to the development that has not yet matured but is being reached through assistance (Vygotsky, 1980). The zone of proximal development is significant because it is not limited to how and what a child can perform independently, but it includes what a child can do with guidance as well.

While the zone of proximal development outlines when and under which circumstances the child will learn best, scaffolding is the "process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (Wood, Bruner, & Ross, 1976, p. 90). Expanding that, Wood et al. (1976) addressed the learning of a child beyond independent learning or learning through imitation, honing in on the time when an adult or advanced other (e.g., parent, tutor, sibling) is helping a child learn. Working hand in hand with the zone of proximal development, it was found that scaffolding occurred once a more advanced other knows the child's current level of development, and that person then pushes the child to the level of developmental potential, assisting if and when the child cannot act independently. In other words, the advanced other provides scaffolding for the child that is teeter-tottering between understood concepts and new concepts (Kail, 2012). The advanced other

can help the child focus on the aspects of the task that are known and can be accomplished independently and then push him/her to try tasks that are in the potential development level.

The scaffolding process requires a number of elements to be present in order to be successful: First, recruitment involves gaining the child's attention to the activity. Second, scaffolding is successful when there is a reduction in degrees of freedom or dividing the activity in to sub-tasks of ones at the child's current developmental level and those in the potential developmental level. Third, direction maintenance requires the advanced other to keep the child on task as well as to push the child to advance to the next task. Fourth, marking critical features occurs when the advanced other remarks on what the child has done compared to what the goal is and points out the discrepancies to the child. Fifth, frustration control by the advanced other will help the child keep cool in the face of errors but should not lead to a dependency for the advanced other. And sixth, demonstration is when the advanced other models the ideal solution for the advanced task to the child (Wood et al., 1976).

While originally formulated for traditional in-person learning, sociocultural theory can be applied to interactive media in three ways: first, technology is already incorporated into the theory; second, scaffolding can be used in the physical operation of the device; third, through co-playing scaffolding is used to interpret content.

First, sociocultural theory is founded on social change and embraces these changes to explain how a child develops. According to Bonk and Cunningham (1998), "as technology advances to alter the available cultural tools and settings, so, too, does it alter mind" (p. 36). This theory is dynamic enough to encompass new technology and interactive media as it is introduced into everyday culture and is systematically changing.

Second, sociocultural theory applies to how a child physically learns to operate the device. When parents are co-playing on a device, whether on a computer, tablet, or smartphone, they are able to assist the child in the functions that are beyond the child's current understanding and development. Parents are providing scaffolding to their children when they are helping children learn what to do when there is a password, how to open a window, clicking, double clicking, 3D clicking, turning on/off volume, charging the battery, and even turning on/off the device. Sociocultural theory is needed to understand the learning that is occurring within the parent/child interaction with the device because it goes beyond understanding the independent actions of the child.

The third addition that sociocultural theory makes to the foundation of child development through interactive media is that parents are enacting scaffolding with their children when they are participating in the educational content together. Lauricella, Barr, and Calvert (2009) had 4 year-old children and their parents read a storybook together on a computer. They found that parents interacted with the children much as they would when co-reading traditional books. They found that "scaffolding by parents during computer use can also expand children's cognitive skills such as vocabulary development, that occur while reading the story" (Lauricella, et.al, 2009, pp. 219-220). In addition, scaffolding can be applied to the computer content itself. Oftentimes a feature of interactive games is that of accelerating difficulty, that the "computer" will assess the level of difficulty and as the child masters that level, they will move on to a more difficult level. This accelerating difficulty is acting as a computer mediated scaffolding for the child. As a child is participating in interactive media they are being evaluated by the technology and presumably will advance to levels that are unknown but not impossible (i.e., in the zone of proximal development) for the child.

Sociocultural theory can explain a number of ways in which children learn while using interactive media. However, each of the explained modalities of learning is limited to the learning that happens interactively and not individually. While positive developmental effects can be seen when parents are co-playing with their children, is co-playing the norm or is children engaging with these devices alone happening more frequently? Kabali et al. (2015) found that by four years old three out of four children had mobile devices of their own, indicating easy access to independent use. Also, three out of four parents had given children a device to use independently while doing chores or to keep the child calm. In addition, Rideout (2014) found that co-playing only accounted for 25-29% of the time a child spends on a computer or mobile device.

Sociocultural theory applies to child development through interactive media because the technological devices act as the cultural context for children's learning. The scaffolding that parents and others provide allow the child to learn challenging techniques in regards to the technology, and push the child to the zone of proximal development by encouraging progress from current understandings to potential knowledge. In other words, sociocultural theory focuses on "the conditions for the possibility of learning" (Cobb, 1994, p. 13). Fisch (2009) indicates that one aspect of computers is that they contribute advancing difficulty to the user, or they respond to the difficulty level needed by the user. This introduces a new application for scaffolding. Because interactive media can assess the child's skill level and presumably challenge them (while not becoming impossible), the software is essentially acting as scaffolding for the child.

Scaffolding is a complex concept. Due to the dynamic nature of scaffolding and the many parts, the concept has been measured in a number of different ways, and there is not a consensus on one right way to measure scaffolding (Van de Pol, Volman, & Beishuizen, 2010).

Measurements such as rating scales and coding schemes have been used on a small scale. However, each of these measurements is specific to the kind of scaffolding delivered (when used as an intervention) and the context of the scaffold. There are two ways to measure for scaffolding. One way, is to measure for the presence of scaffolding. This would be done by looking over manuscripts and coding for words or phrases considered scaffolding. The second way, is to test for effective scaffolding. This would be measured by giving a pre-test to the subjects, exposing them to content with scaffolding, and then giving a post-test to measure if the scaffolding made a difference pre-and post- the scaffolding exposure.

In the context of an interactive game, there is not actual dialogue happening that can be audio recorded and coded for scaffolded content. In the context of this experiment, the character presence will act as scaffolding only to those children whose developmental stage is in the zone of proximal development while playing the game. As such, the older children (7 year olds) will not receive scaffolding because their learning is beyond that of content in the Alpha-Pig game. However, the children in the lower grade level, kindergarten, will be exposed to scaffolding because they are at the beginning stages of literacy provided in the Alpha-Pig game.

According to sociocultural theory, children learn from others in their surroundings. Those others will assist children in learning at a level they are unable to reach on their own thorough scaffolding. The effect between a child and the scaffolding provider comes from the dyad's interactivity, and that interaction can be completed by a mediated character (Rafaeli, 1988). Scaffolding can be applied to the computer content itself. Oftentimes, a feature of interactive games is that of accelerating difficulty, meaning that the "computer" will assess the level of difficulty a child needs and as the child masters that level, the software will move the child to a more difficult level. This accelerating difficulty is acting as computer mediated scaffolding for

the child. As a child is participating in interactive media they are being evaluated by the technology and presumably will advance to levels that are unknown but not impossible (i.e. in the zone of proximal development) for the child. In educational games that include a character, there is the possibility that the character will provide scaffolding to the children. Scaffolding would be seen in the character as the program assesses the ability of the child and has him/her repeat a level or move on to the next. As the child is pushed to reach beyond his/her current knowledge, the scaffolding will lead to greater learning. In the context of an educational game, scaffolding can be identified by the presence of the zone of proximal development. For example, when a child is blocked from moving forward at a steady or fast pace, then the software (or character) is holding the child back and helping the child to learn and move forward as he/she masters the content. Children who need assistance from the character in the game, or who are told to try again are experiencing the scaffolding provided by the character. On the other hand, the children who move quickly through the game are past the zone of proximal development and are not being aided by the character.

In order for scaffolding to occur, children need to be advancing from a current level of development. When focusing on childhood literacy, a child's current level of development has been studied in a number of ways. Previous research on childhood literacy development focused on reading readiness and began literacy activities once the child began school. In recent years, this thought process has changed and is now focusing on emergent literacy (Piasta, 2016; Roskos &Christie, 2000). The study of emergent literacy is to study the continuous development of reading and writing. Emergent literacy is a continuation of individual and cultural learning theories such as constructivism and sociocultural theory. Emergent literacy begins for a child with activities such as "talking, drawing or playing, rather than adult like behaviors like reading

a book, or writing a letter" (Roskos & Christie, 2000, p. 154). Children begin learning letters and writing before they enter kindergarten. They are learning to talk, read, and write concurrently in a non-academic setting, such as their surroundings and through every day interaction with more advanced others who already have oral, reading, and writing skills (Whitehurst & Lonigan, 1998).

Emergent literacy applies to interactive media because many games for children target children under five years old. The Apple App store has a specific label given only to games that target children under five years old: "Rated 4+ made for ages five and under." ABCMouse is an example of an educational game made specifically for children under five. The app was rated as the second most popular app for kids in March of 2015, and had approximately 543,000global downloads (ABCmouse.com, n.d.). Educational apps made for preschool aged children are founded on the principle of emergent literacy, because these games are a way for children to learn print skills in a non-academic setting in the form of a game. As interactive media becomes part of a child's everyday surroundings (CSM, 2013; Kabali, 2015), the interactions become a source of emergent literacy.

Relying on the game to offer emergent literacy and scaffolding to children who are at the appropriate developmental stage, the educational game will further children's knowledge on the subject matter to which they are exposed. The game will be a source of emergent literacy by exposing the children to oral, reading, and writing skills, in essence, teaching them these skills in a non-academic setting. Adding the educational exposure to the scaffolding received in the game, children playing the game will be able to score higher on the subsequent worksheet.

Hypothesis 3: Children who play an interactive character educational game will have better scores on a subsequent educational worksheet than those who watched an (a) educational video and a (b) control group.

To identify effective scaffolding, children in the game condition would score higher on a subsequent educational worksheet because those children in the game condition are being exposed to scaffolding from the interactive character. However, since kindergarteners and 1st graders are at different levels of literacy, they will experience the scaffolding differently. As kindergarteners are exposed to a game with letter recognition, they are being challenged since they are in the zone of proximal development, therefore, the character is aiding them in advancing to a new level of literacy. Alternatively, 1st graders have already advanced beyond the zone of proximal development in regards to letter recognition so, they will not show an effect from the aid of the character offering scaffolding. Due to this, an interaction effect will occur, where kindergarteners in the game condition will perform better than kindergarteners in the other two conditions, while there will be no evidence of effective scaffolding for 1st graders because each condition will score similarly on the educational worksheet. Higher scores for Kindergarteners in the game condition will show that the scaffolding present in the game is effective scaffolding.

Hypothesis 4: There is a difference in children's scores on the subsequent worksheet based on the joint interaction of their grade level and exposure condition, such that there is no difference in experimental condition among 1st graders, but kindergartners will score higher than the other two experimental conditions.

Due to the difference in nature of the interactive game and the video, while both stimuli teach letters and words, children in the interactive game condition will have different outcomes

than those in the video condition and control condition. Game and video developers' attempts at using scaffolding in both educational games (through interaction) and educational videos (through participatory cues) are evident. However, there are differences in the nature of the scaffolding offered in the two stimuli. Elements needed to produce actual scaffolding will be more evident through the interactive nature of the game versus the more sedate nature of watching a video, the continuation of the game versus the finite content of the video, and the direct responses offered by the interactive character versus mere participatory cues used in the video. These differences in scaffolding per stimuli will prompt the child to have more motivation toward the educational worksheet and continue to learn because of a high level of engagement with the educational game. Furthermore, those children who were not challenged and did not receive scaffolding will have less motivation toward the worksheet and learning because the lack of a challenge will have left the children bored.

Hypothesis 5: Children in the educational game condition will show (a) more motivation toward a subsequent educational activity and (b) more motivation toward future learning than the educational video group and the control group.

Kindergarteners and 1st graders are at different levels of literacy. By the time a child is in 1st grade that child will have had a full year more of formal literacy education than that of a child in kindergarten. Due to the 1st grader's advanced knowledge in literacy, 1st grade children in the game condition will not be as affected by the scaffolding offered from the character. Most 1st graders will be beyond the zone of proximal development when playing the game so the game will be easy for them. Because the game is less challenging for 1st graders, they will not show more motivation toward the worksheet in the game condition versus the video and the control conditions. Conversely, the kindergarteners will be in the zone of proximal development and will

be exposed to scaffolding while they play the game so kindergarteners in the game condition will show more motivation, because they were engaged and challenged by the game, than kindergarteners in the other two conditions.

Hypothesis 6: There is a difference in children's (a) motivation toward completing the worksheet and (b) motivation toward future learning based on an interaction between their grade level and exposure condition. Such that 1st graders in the game condition will not differ from those in the video and control group, but kindergarteners will have higher motivation in the game condition than kindergarteners in the video and control groups.

Method

An experiment was conducted in order to examine the effects of children playing education games with a character on a tablet and their subsequent attitudes and behaviors.

Participants

Children between the ages of 5 and 7 were recruited for this project from two elementary schools in the Phoenix area and one playgroup in the surrounding area. An Institutional Review Board responsible for human subjects research at The University of Arizona reviewed this research project and approved the project. A total of 158 children in kindergarten and first grade classes completed the experiment. Seven children were excluded because they were outside of the age range. Data from the remaining 151 children were included in the analysis. The participants were slightly more male ($N = 78$) than female ($N = 73$). More first graders ($N = 83$) than kindergartners ($N = 63$) participated, and 5 participants did not record their grade level. There were 5 year olds ($N = 42$), 6 year olds ($N = 71$), and 7 year olds ($N = 38$), and on average the children were 5.97 years old ($SD = .73$). For a three-group between subjects experiment, a

sample size of 151 produces sufficient power to detect medium effect sizes (r = .30, α = .05) was found (power = .91).

Design

The conditions in the three-group between-subjects experiment consist of: educational character game, educational character video, and a control group of non-educational no character activity. The educational game condition included educational content and interaction with Alpha-Pig, the educational video included educational content and participatory cues from Alpha-Pig, and the control group was not exposed to educational content or Alpha-Pig and just colored on the tablet, this offered a neutral activity for those in the control group while still exposing them to the engagement with the tablet. The game used for this project was Super Why produced by PBS, this game was chosen because PBS had already reported learning gains for children from the game (Chiong & Shuler, 2010) The section of the game with the Alpha-Pig level was chosen because Alpha-Pig is the most gender-neutral character in the show; the other characters in the show are Super Why (a boy dressed in a super hero costume), Wonder Red (a girl wearing roller skates), and Princess Presto (a girl in a ball gown). Participants in the educational game condition (n = 48) were given a tablet and asked to play the educational app Super Why! Power to Read (PBS Kids, 2017) with the character Alpha-Pig. Those in the educational video condition (n = 51) watched a compilation of videos containing Alpha-Pig on a tablet. And those in the control group (n = 52) were given a tablet and asked to color using the app Doodle Coloring Book (Bubadu, 2016). Children were randomly assigned to each condition.

Procedure

There were three elements to this project: a parent consent form, a parent survey, and the experiment with the child. In order to obtain consent from the parents, a letter was sent home

with each child, from school or play group, to parents requesting consent for the child to participate in the study. To administer the parent survey, an email address was solicited on the consent form. Then, a link to the parent questionnaire was sent to the provided email address. The background survey assessed household information, previous parasocial relationships, familiarity with the mobile game app, and other unrelated measures. A $10 Amazon gift card was provided to all parents who filled out the background questionnaire after their child completed the experiment. Children who had obtained consent from a parent/guardian were randomly assigned to one of the three experimental conditions. Each condition consists of 10 minutes on the tablet.

The researcher went to the child's class or play group and escorted the child to the classroom where the experiment was taking place. Once the child arrived, the researcher obtained verbal consent from the child that he/she wanted to participate. After which, the child was given a tablet and asked to use it for 10 minutes. An and Stern (2011) found that 10 minutes of play time was sufficient time to move through one stage of a game. Children in the game condition were asked to play Super Why! Power to Read (PBS Kids, 2017) with the character Alpha-Pig. The game would give the child a 3-7 letter word and have them spell the word letter by letter giving them options for each letter. For example, Alpha-Pig would appear and give the child a word to spell such as "queen" (see Appendix A). Once the full word was given, Alpha-Pig would say "we need to find the letter 'Q,' do you see the 'Q'?" If the child picked correctly, then Alpha-Pig would move to the next letter in the word. If the child picked incorrectly, Alpha-Pig would say "That's not a 'Q' can you find the 'Q'?" If at any time the child would select the correct letter before being prompted by Alpha-Pig, the game would proceed without Alpha-Pig speaking. Children in the video condition watched four short clips (adding up to 10 minutes) of

the show Super Why containing the character Alpha-Pig. Each clip was of a tough situation that Alpha-Pig ended up in (stuck on the wrong side of the river) and Alpha-Pig would spell something that would help them out of the bad situation (spell the word bridge). Finally, children in the control group were asked to color on the app Doodle Coloring Book (Bubadu, 2016) for 10 minutes. The screen was blank and the children were given options of different colors to color on the sheet. See Appendix A for screen shots of each condition.

As the children were using the tablet, the researcher stayed near the child to observe the tablet usage. The researcher tallied the correct letters and words spelled in the game condition. For the video and control group, the researcher was there to make sure the child did not exit out of the app or try to play/do something different.

Following the game, each child completed a subsequent educational worksheet where they were asked to match lower case letters with upper case letters. There were eight upper case letters and eight lowercase letters that the children were given five minutes to complete. The sheet had the character Alpha-Pig if the children were in the game or video condition and did not have Alpha-Pig on it if they were in the control group.

After completing the worksheet, children were then asked a series of questions in a post-test questionnaire. Finally, to thank them for helping, the children were offered a prize before they left. In order to test if the character had an effect on their subsequent behavior, children from each group chose between an educational prize (an Alpha-Pig activity book) with the character on it or a non-educational prize (an Alpha-Pig coloring book) with the character on it. The children were sent home with the prize of their choice and a letter of thanks to their parents.

Measures

The post-test consisted of questions about the children's motivation for future learning, familiarity with the show and character, and questions about their relationship to the character from the game and video. The questions in the measures have all been designed specifically for children or have been adapted to be age appropriate. The questions were measured on a Likert type scale using a series of smiley faces (Castonguay, 2015; Michela & Contento, 1986; Richards & Calvert, 2016). Questions were asked verbally and recorded on surveysoftware using a tablet.

Motivation. Calvert et al.'s (2007) measure for motivation developed specifically for children was adapted for this project. Motivation toward the worksheet was measured with one item question: "After you used the tablet, how much did you want to do the worksheet?" (M = 4.34, SD = .99). This item was measured on a 5-point scale options included *very much* (coded as 5) *not at all* (coded as 1). Each option had a series of smiley faces under the options to indicate what each scale option meant. The motivation toward future learning was measured with one item: "Now that you have used the tablet and done the worksheet, how much do you want to keep doing things to help you learn?" (M = 4.68, SD = .85). This item was measured on a 5-point scale options included *very much* (coded as 5) *not at all* (coded as 1).

Parasocial interaction. This study adapted Hartmann and Goldhoorn's (2011) six item experience parasocial interaction (EPSI) scale to measure a person's own reporting of parasocial interaction with a character and Bond and Calvert's (2014) six item scale for parents to report parasocial interaction of their children. The new child EPSI scale consists of six items rated on a five-point scale. To adapt this measure for children, the five-point scale is represented as a series of circles increasing in size. The smallest one indicating *not at all* (coded as 1) and the largest one with a big circle indicating *very much* (coded as 5). The measure consisted of questions such

as:While using the tablet, did you feel like Alpha-Pig was listening to or watching you and While using the tablet, did you feel like Alpha-Pig knew your answer was right or wrong?

Variations of this method to test young children have been successfully used in previous studies (Castonguay, 2015; Michela & Contento, 1986; Richards & Calvert, 2016). The mean of the six items was computed for this study, using only the game and video group ($M = 3.52$, $SD = 1.39$, $\alpha = .96$).

Task score. The educational activity completed by children consisted of a worksheet containing eight lowercase letters to be matched to eight uppercase letters. The worksheet was scored for correctness of answers. Scores can range from 0 (zero correct answers) to 8 (all eight letters matched correctly; $M = 7.87$, $SD = .84$).

Reward choice. Reward choice was measured by matching the game condition with the child's choice of prize. All children were given the option of selecting an educational reward (activity book) with a character on it or a non-educational reward (coloring book) with the character on it (Appendix B). To show that children's behavior was affected by the educational content of the game or video, children in the game condition would have to choose the educational activity book ($n = 23$) significantly more than video condition ($n = 20$), and the control condition ($n = 19$).

Manipulation Check

Two questions were constructed for this projects as a manipulation check. Children were asked "While using the tablet, what did you do?" and given the response options of "play a game, watch a video, color." The child then selected one of the three options offered for checking which condition they participated in. A two-way Chi-square tests showed that children

were more likely than chance to report the condition they were actually in, χ^2 (2) = 262.75, N = 151, $p < .01$, $\phi = 1.74$. See Table 1 for percentages and adjusted standardized residuals.

Table 1

Percentage of Child Reported Condition Check

	Game	Video	Control
Play a game	98%(11.0)	2.1%(-5.4)	0%(-5.9)
Watch a video	8%(-5.0)	92%(11.4)	0%(-6.2)
Color	3.8%(-5.8)	0%(-6.1)	96.2%(11.9)

Note: Numbers in parentheses are adjusted standardized residuals. Values higher than +/-1.96 indicate significant results.

To check if children were understanding the educational nature of the game and the video, the children were asked "While using the tablet what helped you learn?" The children's answers were coded as "something helped me learn" if they responded with items such as letters, Alpha-Pig, spelling. Answers were coded as "nothing helped me learn" if they responded with nothing or items such as coloring. This acted as a check that they are aware they are being exposed to educational content in the game and video condition. A two-way Chi-square test showed that children in the game and video were more likely than chance to indicate something helping them learn than the control group, χ^2 (2) = 46.18, N = 151, $p < .01$, $\phi = .31$.

Table 2

Percentage of Child Reported Learning Check

	Game	Video	Control
Something helped me learn	71%(3.6)	69%(3.3)	12%(-6.8)
Nothing helped me learn	30%(-3.6)	31%(-3.3)	88%(6.8)

Note: Numbers in parentheses are adjusted standardized residuals. Values higher that 1.96 indicate significant results.

Results

Parasocial Interaction

Hypothesis 1 predicted that those who played an educational game with an interactive character would engage in a more intense parasocial interaction with Alpha-Pig than those who watched a video with Alpha-Pig. See Table 3 for the means and standard deviations for each dependent variable. A *t*-test was run to test the parasocial interaction of the children and found that there was not a significant difference between the two groups, $t\ (97) = .51$, $p = .514$, $d = .13$. Hypothesis one was not supported.

Table 3

Child Reported PSI

	Game		Video	
	M	*SD*	*M*	*SD*
PSI	3.61	1.40	3.43	1.38

Reward Choice

Hypothesis 2 predicted that when compared to the control group, (a) children in the game condition would pick the educational reward more often than the non-educational reward and that (b) children exposed to educational content (game condition and video condition) would pick the educational reward more often than the non-educational reward. There were two options of rewards given to the children: an activity book with similar worksheets as done in the session

containing pictures of Alpha-Pig and other Super Why characters (educational) and a coloring book of Alpha-Pig and other Super Why characters (non-educational).

A two-way chi-square was run to test the reward chosen between the conditions. Results indicate that children in the game condition did not pick the activity book significantly more than the children in the video or control condition, χ^2 (2) = 1.44, N = 151, p = .49, ϕ = .01. Additionally, the one-way chi-square was used to test the expected outcome of each the game and video condition based on the percentages of the control group. Results indicate that when testing reward choice by condition using control group expectancies, there was no significant difference in the proportion of times the activity book was chosen over the coloring book in the game condition (χ^2 (1) = 2.70, N = 48, p = .10, ϕ = .06) or the video condition (χ^2 (1) = .162, N = 51, p = .687, ϕ = .003).

Table 4

Reward Chosen by Condition

	Game		Video		Control
	K	1st	K	1st	
Activity Book (Educational)	63%	43%	63%	29%	36.5%
Coloring Book (Non-Educational	37%	57%	37%	71%	63.5%

To examine difference between kindergarteners and 1st graders, further one-way chi-squares were run using the control group expected proportions and the conditions based on grade level. For kindergarteners, a one-way chi-square indicates that when the game condition is compared to the control group's expected outcomes, kindergarteners in the game condition chose the activity book significantly more than the coloring book based on the expected outcomes of the control group (χ^2 (1) = 4.67, N = 16, p = .031, ϕ = .29). And, kindergarteners in the video condition

chose the activity book significantly more than the coloring book (χ^2 (1) = 4.67, N = 16, p = .031, ϕ = .29). Hypothesis 2 was partially supported, support for hypothesis 2 was only found among kindergarteners. Results can be seen in Table 4.

Scaffolding

Hypothesis 3 predicted that children in the game condition (M = 7.71, SD = 1.41) would score higher on the subsequent educational worksheet than those who watched the video (M = 7.92, SD = .39) and those in the control group (M = 7.98, SD = .14). A one-way ANOVA was run, and found that there were no differences between groups on the score achieved on the subsequent educational worksheet, F (2, 148) = 1.46, p = .235, η^2 = .02. Hypothesis 3 was not supported.

Hypothesis 4 predicted that there is a difference in children's scores on the subsequent worksheet based on their grade level and exposure condition. A univariate general linear model was run to test for the interaction effect of grade level and condition on score on the worksheet and found no significant interaction between condition and grade on the child's worksheet score, F (2, 146) = .10, p = .905, η^2 = .001. Hypothesis 4 was not supported.

Motivation

Hypothesis 5a predicted that children in the game condition (M = 4.27, SD = .98) would have higher motivation toward the subsequent educational worksheet than those who watched the video (M =4.41, SD = .94) and those in the control group (M = 4.35, SD = 1.06). A one-way ANOVA was run, and showed that there were no differences between groups on motivation toward the worksheet, F (2, 148) = .246, p = .782, η^2 = .01. Additionally, hypothesis 5b predicted that children in the game condition (M = 4.63, SD = .84) would show more motivation

toward future learning than those who watched the video ($M = 4.59$, $SD = 1.00$) and those in the control group ($M = 4.81$, $SD = .66$). A one-way ANOVA was run, and found that there were no differences between groups on motivation toward future learning, $F\ (2, 148) = .994$, $p = .373$, $\eta^2 = .003$. Hypotheses 5a and 5b were not supported.

Table 5

Summary of Hypotheses and Findings

Hypothesis	Findings
H1: Game condition would have more intense PSI than video condition	Not supported
H2: Activity book chosen more often than coloring when exposed to educational material and coloring book chosen when exposed to coloring	Partially supported
H3: Game condition would score higher on worksheet	Not supported
H4: Interaction - game condition and kindergarteners would have score higher on worksheet	Not supported
H5: Game condition would have more motivation toward worksheet and future learning	Not supported
H6: Interaction - game condition and kindergarteners would have more motivation toward worksheet and future learning	Not supported

Hypothesis 6a predicted that there is a difference in children's motivation toward completing the worksheet and 6b predicted a difference in their motivation toward future learning based on their grade level and exposure condition. A univariate general linear model was run to test for the interaction effect of grade level and condition on motivation to do the worksheet and found no significant interaction condition and grade on the child's motivation to do the worksheet , $F\ (2, 146) = 1.27$, $p = .283$, $\eta^2 = .018$. And, a univariate general linear model was run to test for the interaction effect of grade level and condition on motivation to continue

learning and found no significant interaction condition and grade on the child's motivation to continue learning, F (2, 146) = .14, p = .866, η^2 = .002. Hypotheses 6a and 6b were not supported.

Discussion

Increased use of mobile devices for educational material make it important to understand what aspects of the interactive media can help children learn, increase their motivation for learning, and effect their decision making. This project focused on the interactive nature of a character used in educational mobile games and children's attitude and behavioral changes due to the influence of parasocial interactions (Horton & Wohl, 1956) and scaffolding (Vygotsky, 1980). The partially supported and non-supported findings warrant discussion.

It was hypothesized that children in the game condition would choose the activity book more often than the other conditions. However, it was found that children in the game, video, and control condition showed no significant difference in choosing the activity book from the coloring book between the three groups. The control condition showed that children not exposed to the stimuli were more prone to choose the coloring book. Thus, while there was a difference in the amount of activity books chosen between groups, the difference was not significant. In the game condition 48% of children chose the activity book, in the video condition 40% chose the activity book, and in the control group 37% chose the activity book. This shows that there was an overall trend in choosing the activity book more in the game condition, as predicted, even though the differences were not significant. One reason these trends were not significant could be because those in the control condition were coloring as their control stimuli, prompting more interest in the coloring books. Another reason could be that the coloring book was not neutral

enough to elicit equal choosing of the coloring book and the activity book among the control group.

Additional testing found that there was a significant difference among kindergarteners between condition and reward chosen. While overall with kindergarteners and 1st graders there was not a significant difference, when looking solely at kindergarteners the educational reward was chosen significantly more often in the game and video conditions than in the control group. One reason for this could be because kindergarteners were in the zone of proximal development being challenged and assisted by the character. Thus, the exposure to the character and the educational nature of the game lead the children in kindergarten and in the game or video condition to choose a reward in-line with those two stimuli, having the character on it and educational in nature.

Even though Hypothesis 1 predicted that there would be a difference in the intensity of the PSI, which did not occur, the combined mean PSI in both the game and video conditions (M = 3.52, SD = 1.39) is above the midpoint, indicating that the children in these conditions experienced a PSI. While the children in the two conditions did not report different levels of PSI, they did indicate experiencing a PSI. This finding can indicate that the interactive nature of the specific game was not different than the interactive nature of the video. The nature of interactive games is different than television because interactive games respond directly to feedback from the user. The most that can happen interactively with television is that production techniques can be used to mimic interaction. For example, television production techniques used to foster PSI include: character verbally addressing the audience, character looking directly into the camera, character adjusting head and eyes toward camera with dialogue seemingly coming from the mind (mouth not moving, as if audience is mind reading), and ease of audience ability to take the

character's perspective (Cohen, 2009). These production components of PSI are evident in interactive games as well and more frequently incorporated than in television shows because the entire game is interactive. Because interactive games include more frequent use of these techniques, it was assumed that children who played an educational game that was interactive would report higher levels of PSI than children who were only exposed to the quasi-interactive character on the video. One possible explanation can be that not all interactive games are the same in their level of interactivity. In particular, this Super Why game did not ask for children's names to address them directly, it did not keep track of any score (right or wrong), and did not interact more than simple directions and announcing a right or wrong choice. In other words, the game used the same basic production techniques (looking at the camera and addressing the user) as the video did. A game that is more interactive would include more characteristics and techniques that lead to a more intense PSI, such as referring to the user by name, tracking scores, and having further conversation than only giving directions.

This study may have been influenced by a ceiling effect for a number of findings, specifically Hypotheses 3, 4, 5, and 6. As seen in Hypothesis 3, children in all conditions scored very high on the educational worksheet. The mean score was 7.87 out of a total of 8. This indicates that there was little opportunity for variation between the conditions. One possibility is that this educational worksheet was too easy for the age group being tested. Due to the lack of variability, this test was unable to identify any learning effects from the conditions the children were exposed to. Unfortunately, because both kindergarteners and 1st graders did equally well on the worksheet, an interaction between condition and grade level could not be identified for hypothesis 4. As hypothesized, the interaction would have shown that kindergarteners in the game condition did better than kindergarteners in the video and control conditions and that 1st

graders did equally well on the worksheet in all three conditions. However, since everyone in the study did very well on the worksheet, a difference in kindergarteners scores among the three different control groups was unable to be identified as predicted.

Results relevant to hypotheses 5 and 6 may be an artifact of a ceiling effect, as there was a lack of support for a difference between groups their grade level and motivation toward doing the subsequent educational worksheet and toward future learning. Both items were measured with 5 indicating "very much" and 1 indicating "not at all." When asked how much they wanted to do the educational worksheet after using the tablet, the children in all conditions ($M = 4.34$) responded between "very much" and "somewhat." This shows that most of the children indicated wanting to do the worksheet. Results were similar when children were asked how much they want to keep doing things that help them learn. All children indicated very positive results ($M = 4.68$) on the same scale as the previous question. One reason for this may be that the children were all in a school setting when they were pulled out to participate so the children already had an educational mindset and knowing this was a type of test, they wanted to do well so participants indicated positive answers only. Additionally, because the researcher asked the questions directly to the subjects, the children could feel a lack of anonymity and might have shown a self-report bias by responding how they thought the researchers wanted them to respond. In other words, this shows a threat to internal validity.

Implications

As educational interactive media differs from educational television, this dissertation has advanced the discipline of communication by examining how traditional media theories apply to new technology and specifically examine the role of interactive characters in the educational content. This project has identified that when children use a basic interactive educational game,

they are able to experience the same level of PSI (Horton & Wohl, 1956) as those children who watch a video with participatory cues. This furthers the knowledge of PSI because it shows that when children are watching a video on the same size screen and at the same distance as they do when they are playing a game, the interactivity of the character in the game versus a character in the video does not make a difference for the child's relationship with the character.

Due to a lack of variability among worksheet scores, this study was not able to identify effective scaffolding (Vygotsky, 1980). However, since the character is aiding children in the zone of proximal development, the game does show evidence of the presence of scaffolding in an educational game with an interactive character. Additionally, since there was a difference in behavioral outcomes for kindergarteners and 1st graders, this project has advanced the research on scaffolding by showing that when children in the zone of proximal development are exposed to scaffolding by an interactive character in an educational setting, those children will show a difference in subsequent behavior (i.e. choosing an educational reward). Scaffolding has mainly been studied as an education tool utilized by parents or more advanced peers and adults. This has opened scaffolding as a construct to be utilized for advancing child development while children play educational games.

These results are found even in a game that utilized rudimentary interactivity. These findings have practical implications in today's society because mobile devices are increasingly being used for educational content and now parents can make more informed decision regarding the content their children are exposed to. For example, some parents may think that a fun character can take away from the learning process; however, this study shows that children are engaging in PSI with the character which can lead to increased learning similar to the findings of previous educational television research (Gola et al., 2013; Lauricella et al., 2011). This informs

parents that educational games with characters are as beneficial to children as they are in educational television.

An important finding regarding grade level is that the behavioral change was only found among kindergarteners, meaning that children were only effected by the interactive character if the child was in the zone of proximal development (Vygotsky, 1980) meaning that the content of the games needs to be age appropriate. For a game to be age appropriate, the game should contain content that is in line with the developmental level for the child of the target age group. Even more effective would be game that assesses a child's current knowledge and offers advancing levels of difficulty. Parents and teachers now know the importance of choosing educational games to use which contain age appropriate content for each child in order to foster mediated scaffolding.

Limitations

This project had a few limitations that should be mentioned. First, there was a flaw in the design by using a game that included an interactive character that was not highly interactive. The stimuli used were chosen with external validity in mind. The educational game used was a previously created game, thus limiting the scope of possibilities the game offered. A game created specifically for the purpose of this project would have added variance between the game and video results. In particular, a game where the character is involved more by speaking more than just to correct the child and if the character showed personalized interaction by referring to the child by name, could possibly have produced a stronger PSI for the child. Additionally, scaffolding could have been measurable on different levels if the game tracked scores and moved to different and more advancing difficulty levels. A custom game tailored specifically to imitate

a more interactive game with levels that show advancing difficulty would strengthen internal validity for future projects.

A second limitation to the project was a restriction in range among the children's scores on the educational worksheet used. Before beginning the project, four first grade teachers were consulted regarding the worksheet and ability for children to complete the worksheet. These teachers advised that it would be a good worksheet to use. Unfortunately, the worksheet was too easy for the children because children in all conditions scored near perfect on the worksheet. This could be due to the fact that data was collected at the end of the school year, assuming that children have mastered the content of the worksheet earlier in the school year. In order to introduce variance in the results of the educational worksheet between older and younger children and between conditions, a more difficult worksheet needs to be used. A worksheet similar to the game would have been more appropriate. For example, a worksheet with a picture of a queen and jumbled letters to make up the given word would be a more appropriate worksheet. With a more difficult worksheet, learning effects between different conditions would be able to be found.

A third limitation lies in the scales used with the different measures. The follow-up questionnaire used three different scales: a set of three smiley faces, a set of five smiley faces, and a set of five circles. This required a higher cognitive load (Fisch, 2000) for the young children than if only one scale were used. Before children took part in the questionnaire, the researcher showed the children each of the scales, explained how they worked, and offered practice questions to assure the child understood. Cutting down the number of scales would cut down on the time used to practice. Additionally, it would reduce the cognitive resources children

allocate to understanding the scale and allow the children to focus more cognitive resources on the questions being asked (Fish, 2000).

Conclusion

Shows like *Sesame Street* and *Blue's Clues* based their content from research using the understanding of child development to create appropriate and effective material (Strasburger, Jordan, & Donnerstein, 2012). When *Blue's Clues* was released in 1996, a trend began where more educational television began using likeable characters to interact with the audience. Since then, it has become more common for educational television shows to include participatory cues where a character on the show will cue the viewer to participate and then wait for a response. The show then continues, no matter the response given by the audience. This is achieved through visual and auditory techniques used to give the viewers guidance (Wartella, O'Keefe, & Scantlin, 2000). As educational television began using research, it evolved and has been able to discover effective ways to teach children through video. Because television has already gone through this evolution, interactive educational games do not have to start at square one; instead, educational games can start off creating games with what is already known about children and educational media.

The expectations when exposing children to an educational game and an educational video were that the educational game would produce different results than the video. However, the results of this project show that children react similarly to an interactive game as they do to a video containing participatory cues. Even though the action of watching a video versus playing a game is quite different, children can experience similar interactions with the character. This knowledge helps media researchers understand the place educational games takes in the media. The findings in this study help to bridge the gap in understanding the difference in the

educational nature of interactive games versus educational videos. Identifying that the gap in applying media effects from video to interactive games is smaller than previously assumed.

This study also found that in an educational context, the interactive character in a game can have a behavioral impact on children as they play a game if the children are being challenged and engaged because they are in the zone of proximal development. Mainly that in order for children to experience these effects, the content of the game needs to be age appropriate and offers content that is just out of children's reach at their current developmental level. In other words, content that the children have not mastered yet. If the children have mastered the material, the content is no longer in their zone of proximal development and they will not need the scaffolding offered by the character so the game will be boring and those children will show no changes in behavior, as seen with the 1st graders. This information helps to authenticate the educational offerings of self-proclaimed educational games.

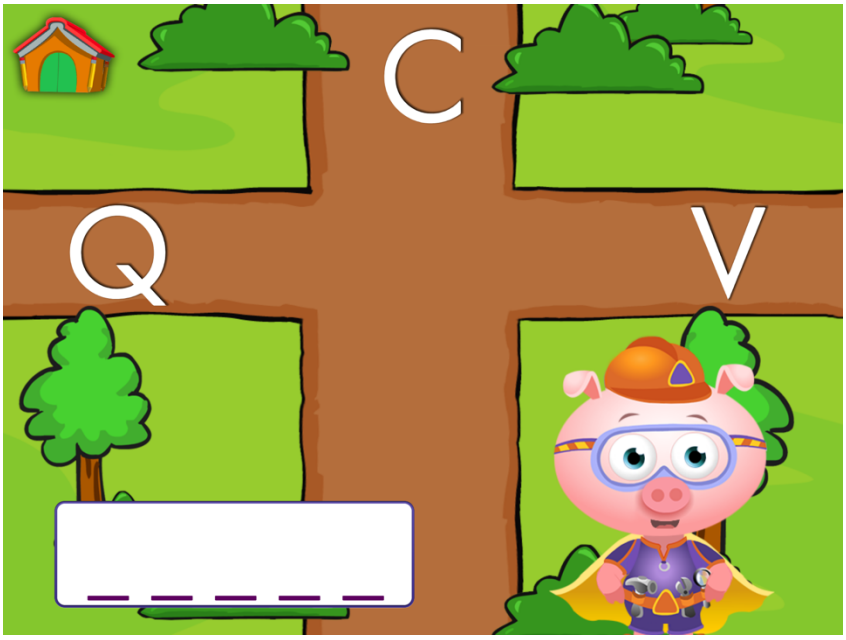
Now PSI and scaffolding can be used to understand a child's development as they engage with educational interactive media. By including likeable characters in games and challenging children with advancing difficulty, game developers can create games that encourage a PSI with the character to incite scaffolding to occur during game play. Additionally, parents can make more educated decisions about what games will provide an educational experience for their children by choosing games with characters which are age appropriate or offer advancing difficulty. Finally, teachers can now more fully understand the developmental process of children using educational interactive games.

The continued study of educational games is necessary to fully understand what aspects of the games have educational effects toward the users. Future studies are needed to address differences in interactivity between various types of games and address other possible

influencing factors within educational games. With added research, parents, teachers, and researchers alike will gain a deeper understanding of how to effectively incorporate educational media in the mobile world of today.

Appendix A
Screen Shots of Stimuli

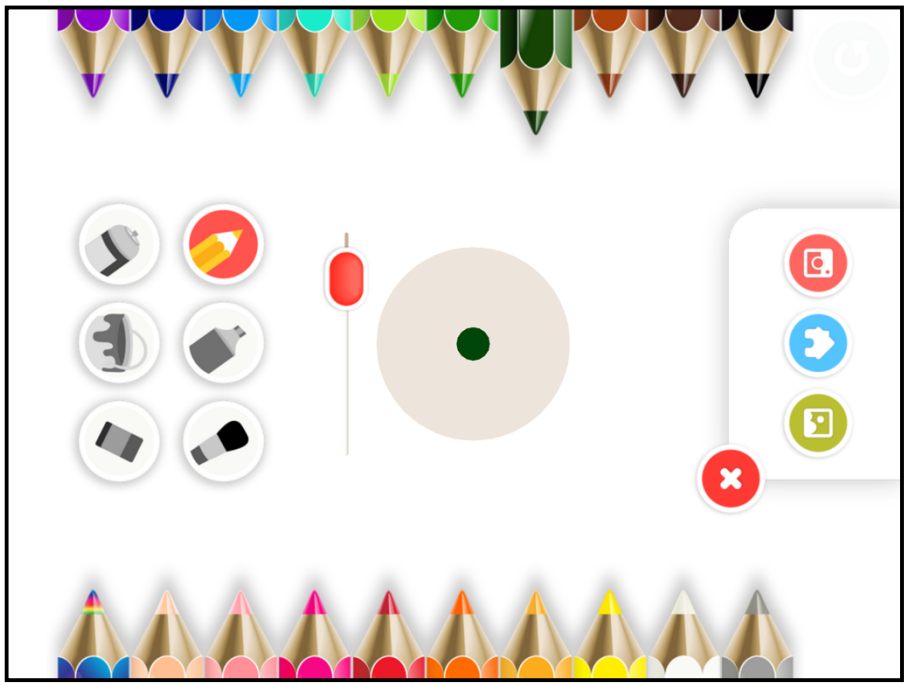
Game Condition

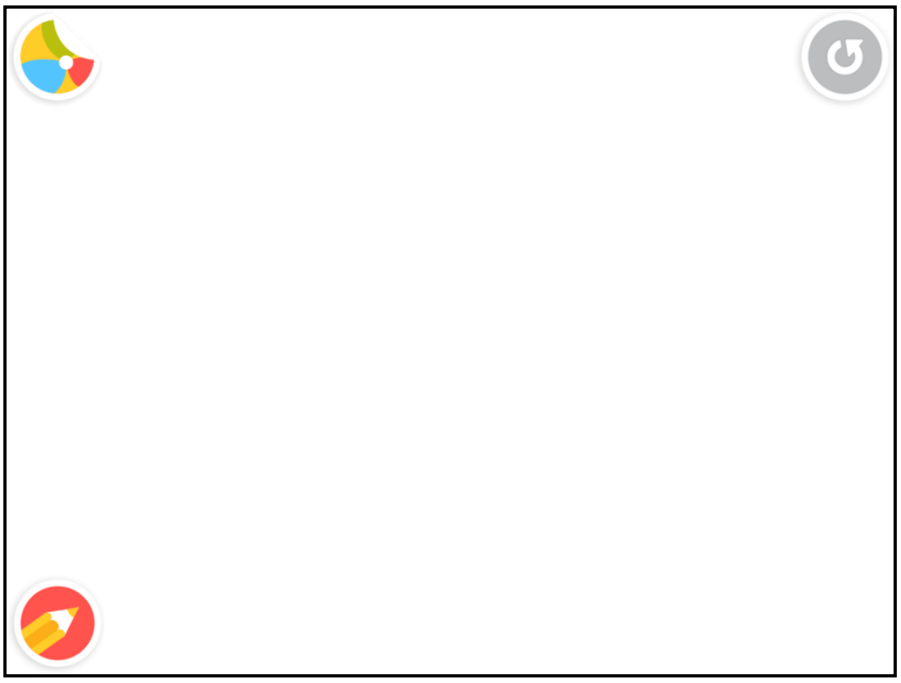


Alpha-Pig tells the user a word and gives them options for spelling it correctly.
For example: “Help me spell the word queen. Where is the letter Q.”

Video Condition

Coloring Condition





Appendix B
Covers of Activity and Coloring Books

SUPER WHY!
COLORING BOOK

Appendix C

Child Survey

Condition

- ❍ Game
- ❍ Video
- ❍ Coloring

Do you know what this show is?

- ❍ Yes
- ❍ No

What is the name of it? _____

Have you watched the show Super Why before today?

- ❍ Yes
- ❍ No

Have you played the game Super Why before today?

- ❍ Yes
- ❍ No

Have you seen Alpha-Pig before today?

- ❍ Yes
- ❍ No

How much fun was it to do the worksheet today?

	Lots of Fun	Sort of Fun	Not Much Fun
1	❍	❍	❍

How much fun was it to use the tablet today?

	Lots of Fun	Sort of Fun	Not Much Fun
	❍	❍	❍

After you used the tablet, how much did you want to do the worksheet?

	Very Much	Some what	Didn't care	Not really	Not at All
1	❍	❍	❍	❍	❍

Now that you have used the tablet and done the worksheet, how much do you want to keep doing things to help you learn?

	Very Much	Some What	Didn't Care	Not Really	Not at All
1	❍	❍	❍	❍	❍

While using the tablet, did anything help you learn?

- ❍ Yes
- ❍ No

What helped you learn? _____

While using the tablet, what did you do?

	Play A Game	Watch a Video	Color
1	❍	❍	❍

While using the tablet, did you feel like Alpha-Pig was listening to or watching

	Not at All	Only a Little	Some What	Quite a Bit	Very Much
1	❍	❍	❍	❍	❍

While using the tablet, did you feel like Alpha-Pig knew you were there?

	Not at All	Only a Little	Some What	Quite a Bit	Very Much
1	❍	❍	❍	❍	❍

While using the tablet, did you feel like Alpha-Pig knew you were listening to and watching him?

	Not at All	Only a Little	Some What	Quite a Bit	Very Much
1	❍	❍	❍	❍	❍

While using the tablet, did you feel like Alpha-Pig knew you paid attention to him?

	Not at All	Only a Little	Some What	Quite a Bit	Very Much
1	❍	❍	❍	❍	❍

While using the tablet, did you feel like Alpha-Pig knew that you followed his directions?

	Not at All	Only a Little	Some What	Quite a Bit	Very Much
1	❍	❍	❍	❍	❍

While using the tablet, did you feel like Alpha-Pig knew your answer was right or wrong?

	Not at All	Only a Little	Some What	Quite a Bit	Very Much
1	❍	❍	❍	❍	❍

Child Subject Code (first name, first two letters of last name, year of birth)

Child's Gender

- ❍ Male
- ❍ Female
- ❍ Other

Who is the researcher/RA?

Where is the session taking place?

What day is the session?

What time is the session

Number of correctly spelled words in game.

Total number of letters picked correctly in game.

Number correct on worksheet

Reward chosen

- Educational - Activity Book
- Non-educational - Coloring book

Appendix D

Parent Survey

Thank you for your participation in this project. The following survey asks a series of questions about digital media and the use of technology in your home. There are no right or wrong answers, we just want to know what you think about the use and growth of your child's media. When asked, answer questions about the child who is taking part in this project. This survey should not take more than 30 minutes. Thank you!

In order to match your information with your child's information, please write the name of your child, the first two letters of the surname, and year of birth. This will act as a code for you and your child to connect your results, while maintaining the anonymity of your answers.

- ❑ Child's first name _____
- ❑ First two letters of last name _____
- ❑ Year of birth _____
- ❑ Code for child: (ChelsieAk1985) _____

What is your gender?

- ❍ Male
- ❍ Female
- ❍ Other

Are you currently

- ❍ Married
- ❍ Widowed
- ❍ Divorced
- ❍ Separated
- ❍ Never married
- ❍ None of these

How would you classify your family?

- ❍ African American
- ❍ White
- ❍ Multi-Racial
- ❍ Asian or Pacific Islander
- ❍ Hispanic or Latino
- ❍ Native American
- ❍ Other please specify _____

What is the highest level of education you have completed?

- ❍ Some high school
- ❍ Some College
- ❍ High school or other equivalent
- ❍ Two-year degree
- ❍ Four-year degree
- ❍ Graduate or professional degree
- ❍ Other

What is the highest level of education you have completed?

- ❍ Some high school
- ❍ Some College
- ❍ High school or other equivalent
- ❍ Two-year degree
- ❍ Four-year degree
- ❍ Graduate or professional degree
- ❍ Other

What was your total household income last year?

- ❍ Less than - $20,000
- ❍ $20,000 - $34,999
- ❍ $35,000 - $49,999
- ❍ $50,000 - $74,999
- ❍ $75,000 - $99,999
- ❍ $100,000 - $149,999
- ❍ $150,000 - $199,999
- ❍ $200,000 or more

What is your relationship to the child participating in the study?

- ❍ Mother
- ❍ Father
- ❍ Legal Guardian
- ❍ Other please specify: _____

How many children do you have?

- ❍ 0
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ More than 4

Do you have a television in your home?

- ❍ Yes
- ❍ No

Which of the following, if any, do you have in your home?

- ❑ Cable or satellite TV
- ❑ Laptop or desktop computer
- ❑ High speed Internet access (cable, wireless, or DSL)
- ❑ An iPad or similar tablet device, such as a Galaxy Tab or other Android tablet, Microsoft Surface, or Kindle Fire
- ❑ A Kindle, Nook, or other e-reader

What type of cell phone, if any, do you have?

- ❑ A “smartphone” (in other words, you can send email, watch videos, or access the Internet on it)
- ❑ A regular cell phone (just for talking or texting)
- ❑ I don’t have a cell phone

One thing that people talk about when it comes to cell phones and tablets is applications or "apps." How sure are you that you know what an "application" is?

- ❍ I know what an app is
- ❍ I have an idea what an app is, but I'm not totally sure
- ❍ I don't know what an app is

Approximately how many apps, if any, have you downloaded onto your:

	None	Under 5	5-9	10-19	20-29	30 +	Don't Know
Smartphone	❍	❍	❍	❍	❍	❍	❍
Tablet (iPad, Kindle Fire, Galaxy Tab, or other Android tablet)	❍	❍	❍	❍	❍	❍	❍

Approximately how many apps that you have you downloaded were for your [child/children] to use on your:

	Most of them	About half of them	Less than half of them	Only a few	None
Smartphone	❍	❍	❍	❍	❍
Tablet (iPad, Kindle Fire, Galaxy Tab, or other Android tablet)	❍	❍	❍	❍	❍

Approximately how many of the apps you've downloaded for your [child/children] are educational apps, that is, apps that are designed to teach kids something?

- ❍ All of them
- ❍ Most of them
- ❍ About half of them
- ❍ Less than half of them
- ❍ None

For this next set of questions, please think about your child taking part in the study. Some of these questions may be about things that child is too young to do. If that's the case, just mark the response that closest applies to that child (or none) and move on.

Which of the following items, if any, does your child use frequently in [his/her] bedroom? (Please check all that apply)

- ❑ Television set
- ❑ Tablet

Which of the following are reasons why your child has a TV in [his/her] bedroom: Mark all that apply.

- ❑ It helps [him/her] fall asleep
- ❑ It keeps [him/her] occupied in their room so I can do other things around the house
- ❑ It frees up the other TVs so other family members can watch their own shows
- ❑ It was a reward for good behavior
- ❑ Because [he/she] shares a room with an older brother or sister
- ❑ Because [he/she] shares a room with an adult
- ❑ Because [he/she] sleeps in a family room that has a TV in it
- ❑ We bought a new TV and decided to give [him/her] the old one
- ❑ To get [him/her] to sleep in [his/her] own room
- ❑ Other _____

Which of the following are reasons why your child has access to a tablet in [his/her] bedroom: Mark all that apply.

- ❑ It helps [him/her] fall asleep
- ❑ It keeps [him/her] occupied in their room so I can do other things around the house
- ❑ It frees up the other screens so other family members can watch their own shows
- ❑ It was a reward for good behavior
- ❑ Because [he/she] shares a room with an older brother or sister
- ❑ Because [he/she] shares a room with an adult
- ❑ Because [he/she] sleeps in a family room that has a tablet in it
- ❑ We bought a new tablet and decided to give [him/her] the old one
- ❑ To get [him/her] to sleep in [his/her] own room
- ❑ Other _____

Which of the following items does your child have, if any? (Please check all that apply)

- ❑ [His/Her] own cell phone
- ❑ [His/Her] own iTouch or other video iPod
- ❑ [His/Her] own non-video iPod or other MP3 player
- ❑ [His/Her] own iPad or similar tablet device
- ❑ [His/Her] own educational game device like a Leapster/LeapPad or V-Tech device (V-Smile, Mobigo, or Innotab)
- ❑ [His/Her] own handheld video game player like a Gameboy, PSP, or Nintendo DS
- ❑ [His/Her] own Kindle, Nook, or other e-reader
- ❑ None of these

If you chose cell phone answer the following:

Is your child's cell phone a "smart phone," or not? (In other words, can [he/she] go online, use apps or watch videos on it, or not?)

- ❍ Yes
- ❍ No

We're interested in whether your child has ever used a cell phone, or tablet to do any of the following activities. Please mark any of the activities your child has ever done:

	On a phone	On a tablet
Watch TV shows or movies	❑	❑
Watch videos	❑	❑
Play games	❑	❑
Use apps	❑	❑
Read books	❑	❑

We're interested in how often your child does various activities, or if [he/she] has never done these activities. How often does your child:

	Several times a day	Once a day	Several times a week	Once a week	Less than once a week	Has never done this	Don't Know
Read or be read to	❍	❍	❍	❍	❍	❍	❍
Watch TV	❍	❍	❍	❍	❍	❍	❍
Use a mobile device (like a smartphone, iPad, iPod Touch, or similar device) to play games, use apps, or watch videos	❍	❍	❍	❍	❍	❍	❍

Thinking just about YESTERDAY, about how much TIME, if any, did your child spend: Please enter the number of hours and minutes. (Minutes should not exceed 59 minutes)

	Hours	Minutes
Listening to music		
Reading or being read to		
Watching TV or videos on a TV set		
Watching videos or TV shows on a handheld device like a smartphone, iPad, or tablet		
Playing non-educational games on a smartphone, tablet, or other mobile device		
Playing educational games on a smartphone, tablet, or other mobile device		
Using other types of apps on a smartphone, tablet, or other mobile device		

How often, if ever, do you do any of the following:

	Often	Sometimes	Hardly ever	Never
Give your child your cell phone, iPod or iPad to play with when you are out running errands together	❍	❍	❍	❍
Give your child headphones and a video on a mobile device to watch when [he/she] has to go with you to a meeting, class, or other activity	❍	❍	❍	❍
Use media to keep your child occupied while you do chores around the house	❍	❍	❍	❍
Use media to keep YOURSELF occupied while you're out playing with your child (for example, use a cell phone, iPod or iPad while you're at the park or playground)	❍	❍	❍	❍

How often, if ever, does your child use the following kinds of apps on a cell phone, iPad, or other tablet device:

	Often	Sometimes	Hardly ever	Never
Educational games, like puzzles, memory games, math, or reading	❍	❍	❍	❍
Games that are just for fun	❍	❍	❍	❍
Creative apps for things like drawing, making music, or creating videos	❍	❍	❍	❍
Apps based on a character [he/she] knows from a TV show	❍	❍	❍	❍
Other types of apps	❍	❍	❍	❍

Please list your child's 3 favorite TV shows:

- ❑ 1 _____
- ❑ 2 _____
- ❑ 3 _____

How educational do you believe each of these shows are?

1 = not at all educational - 7 = extremely educational

	1	2	3	4	5	6	7
TV show 1	❍	❍	❍	❍	❍	❍	❍
TV show 2	❍	❍	❍	❍	❍	❍	❍
TV show 3	❍	❍	❍	❍	❍	❍	❍

Please list your child's 3 favorite movies:

- ❑ 1 _____
- ❑ 2 _____
- ❑ 3 _____

How educational do you believe each of these movies are?

1 = not at all educational - 7 = extremely educational

	1	2	3	4	5	6	7
Movie 1	❍	❍	❍	❍	❍	❍	❍
Movie 2	❍	❍	❍	❍	❍	❍	❍
Movie 3	❍	❍	❍	❍	❍	❍	❍

Please list your child's 3 favorite mobile apps:

- ❑ 1 _____
- ❑ 2 _____
- ❑ 3 _____

How educational do you believe each of these apps are?

1 = not at all educational - 7 = extremely educational

	1	2	3	4	5	6	7
App 1	❍	❍	❍	❍	❍	❍	❍
App 2	❍	❍	❍	❍	❍	❍	❍
App 3	❍	❍	❍	❍	❍	❍	❍

Has your child ever watch the TV show SuperWhy before?

- ❍ Yes
- ❍ No
- ❍ Don't Know

Has your child ever played the mobile game SuperWhy before?

- ❍ Yes
- ❍ No
- ❍ Don't Know

Has your child seen the character Alpha-Pig before today?

- ❍ Yes
- ❍ No
- ❍ Don't Know

Write the name of your child's favorite character associated with a TV show, movie, or app.

_____

Answer the following questions regarding your child's favorite character.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
your child thinks that the character can see him/her when your child views the character on a screen, like a television, computer monitor, or iPad.	❍	❍	❍	❍	❍
your child thinks that the character can hear him/her when your child views the media character on a screen, like a television, computer monitor, or iPad.	❍	❍	❍	❍	❍
your child acts like the character is interacting with him/her when viewing the character on a screen, like a television, computer monitor, or iPad.	❍	❍	❍	❍	❍
your child greets the character (says 'hi,' waves, etc.) when the character first appears on a screen, like a television, computer monitor, or iPad.	❍	❍	❍	❍	❍
your child talks to the character when the character is portrayed on a screen.	❍	❍	❍	❍	❍
When the character asks my child to perform a certain behavior (like pointing to the screen or clapping), your child performs the behavior.	❍	❍	❍	❍	❍

How do you think your child's school performance is?

- ❍ Much above average
- ❍ Above average
- ❍ About average
- ❍ Below average
- ❍ Much below average
- ❍ Don't know
- ❍ Doesn't go to school

How much does your child enjoy learning activities, including school, homework, and educational games?

- ❍ Often
- ❍ Sometimes
- ❍ Hardly ever
- ❍ Never

Has your child had any problems with the following behaviors over the past 6 months. Please answer all the items the best you can.

	Never	Sometimes	Often
Acts wilder or sillier than others in groups (birthday parties, recess)	❍	❍	❍
Interrupts others	❍	❍	❍
Gets out of seat at the wrong times	❍	❍	❍
Gets out of control more than friends	❍	❍	❍
Blurts things out	❍	❍	❍
Acts too wild or 'out of control'	❍	❍	❍
Has trouble putting the breaks on his/her actions	❍	❍	❍
Gets in trouble if not supervised by an adult	❍	❍	❍
Becomes too silly	❍	❍	❍
Talks at the wrong time	❍	❍	❍
Resists or has trouble accepting a different way to solve a problem with schoolwork, friends, chores, etc.	❍	❍	❍
Becomes upset with new situations	❍	❍	❍
Tries the same approach to a problem over and over even when it does not work	❍	❍	❍
Acts upset by a change in plans	❍	❍	❍
Resists change of routine, foods, places, etc.	❍	❍	❍
Has trouble getting used to new situations (classes, groups friends)	❍	❍	❍

Has your child had any problems with the following behaviors over the past 6 months. Please answer all the items the best you can.

	Never	Sometimes	Often
Thinks too much about the same topic	❍	❍	❍
When given three things to do, remembers only the first or last	❍	❍	❍
Has a short attention span	❍	❍	❍
Has trouble concentrating on chores, schoolwork, etc.	❍	❍	❍
Is easily distracted by noises, activity, sights, etc.	❍	❍	❍
Has trouble with chores or tasks that have more than one step	❍	❍	❍
Needs help from an adult to stay on task	❍	❍	❍
Forgets what he/she was doing	❍	❍	❍
When sent to do something, forgets what he/she is supposed to get	❍	❍	❍
Has trouble finishing tasks (chores, homework)	❍	❍	❍
Has trouble remembering things, even for a few minutes	❍	❍	❍
Is disturbed by change of teacher or class	❍	❍	❍

How seriously did you take this survey?

_____ 0 means you didn't pay any attention and 100 means you payed attention to each question.

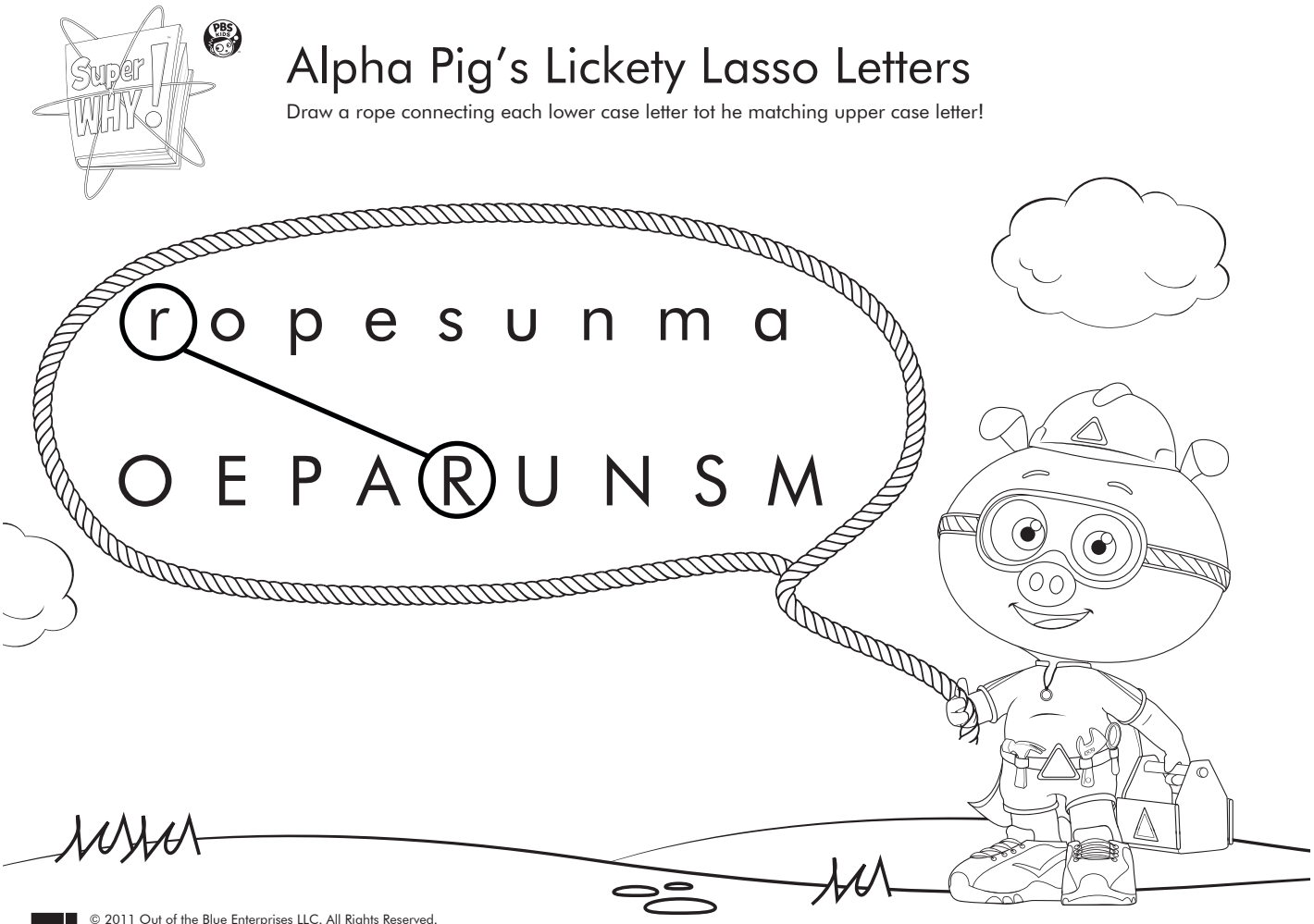
Thank you for participating in our study, 'Unlocking the Tablet: Scaffolding and Parasocial Interactions from Educational Mobile Game Apps.' Please know that your participation has not only helped to increase knowledge among academic circles, but can help improve the quality of educational children's games. We hope you have enjoyed your experience in this research and continue to discuss educational benefits of using a tablet at home. It is people like you that allow us to expand our knowledge and hopefully make changes to benefit our children's future. If you would like more information about children's educational games, or you would like to receive a copy of the results of this study please email your request to cakers@email.arizona.edu.

I would be happy to assist you. Once both you and your child have participated in the study, you will be emailed a digital $10 Amazon gift card. Please enter a primary email address to send the gift card to. Additionally, please provide a second email or a phone number in case there is something wrong with the first email address. Your name, email and phone number are required to receive the gift card, however, will not be stored with your survey results. Thus, all your answers will remain anonymous.

- ❑ First and Last Name _____
- ❑ Email 1: _____
- ❑ Email 2: _____
- ❑ Phone Number _____
- ❑ I do not have an email address, please mail me a gift card. Address: _____

Appendix E

Subsequent Worksheet



References

ABCmouse.com - Early Learning ... for iPhone. (n.d.). xyo.net. Retrieved March 20, 2015, from http://xyo.net/iphone-app/abcmouse-com-early-learning-academy-odAQVi0/

An, S., & Stern, S. (2011). Mitigating the effects of advergames on children. *Journal of Advertising*, *40*(1), 43-56.

Anderson, D. R., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing behavior and impact. *Media Psychology*, 2(2), 179-194.

Anderson, C. A., & Murphy, C. R. (2003). Violent video games and aggressive behavior in young women. *Aggressive behavior*, *29*(5), 423-429. doi: 10.1002/ab.10042

Anderson, D. R., Huston, A. C., Schmitt, K. L., Linebarger, D. L., Wright, J. C., & Larson, R. (2001). Early childhood television viewing and adolescent behavior: The recontact study. *Monographs of the Society for Research in Child Development*, i-154.

Aziz, A., Azah, N., Batmaz, F., Stone, R., & Chung, P. W. H. (2013, October). Selection of touch gestures for children's applications. In *Science and Information Conference (SAI), 2013* (pp. 721-726). IEEE.

Bandura, A. (2004). Health promotion by social cognitive means. Health Education & Behavior, 31(2), 143-164.

Barr, R., Lauricella, A., Zack, E., & Calvert, S. L. (2010). Infant and early childhood exposure to adult-directed and child-directed television programming: Relations with cognitive skills at age four. *Merrill-Palmer Quarterly*, *56*(1), 21-48.

Bond, B. J., & Calvert, S. L. (2014). A model and measure of US parents' perceptions of young children's parasocial relationships. *Journal of Children and Media*, *8*(3), 286-304. doi: 10.1080/17482798.2014.890948

Bonk, C. J., & Cunningham, D. J. (1998). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse, 25.*

Brewer, R., Anthony, L., Brown, Q., Irwin, G., Nias, J., & Tate, B. (2013, June). Using gamification to motivate children to complete empirical studies in lab environments. In *Proceedings of the 12th International Conference on Interaction Design and Children* (388-391). ACM.

Brooks, J. G. (1990). Teachers and students: Constructivists forging new connections. *Educational Leadership, 47*(5), 68-71.

Bubadu. (2016). Doodle Coloring Book (Version 1.12) [Mobile application software]. Retrieved from http://play.google.com

Calvert, S. L., & Kotler, J. A. (2003). Lessons from children's television: The impact of the Children's Television Act on children's learning. Journal of Applied Developmental Psychology, 24(3), 275-335.

Calvert, S. L., Strong, B. L., Jacobs, E. L., & Conger, E. E. (2007). Interaction and participation for young Hispanic and Caucasian girls' and boys' learning of media content. *Media Psychology*, *9*(2), 431-445. doi: 10.1080/15213260701291379

Castonguay, J. (2015). Sugar and Sports Age Differences in Children's Responses to a High Sugar Cereal Advertisement Portraying Physical Activities. *Communication Research*, 1-18. doi: 10.1177/0093650215587357

Chiong, C., & Shuler, C. (2010). Learning: Is there an app for that. In *Investigations of young children's usage and learning with mobile devices and apps. New York: The Joan Ganz Cooney Center at Sesame Workshop*.

Cobb, P. (1994). Where is the mind? Constructivist and sociocultural perspectives on mathematical development. *Educational researcher, 23*(7), 13-20.

Cohen, J. (2009). Mediated relationships and media effects: Parasocial interaction and identification (pp. 223-236). In R. L. Nabi & M. B. Oliver (Eds.), Sage Handbook of Media Processes and Effects. Thousand Oaks, CA: Sage.

Common Sense Media. (2015). The common sense consensus: Media use by tweens and teens. Commonsensemedia.org. Retrieved from https://www.commonsensemedia.org/research/the-common-sense-census-media-use-by-tweens-and-teens

Common Sense Media. (2013). Zero to eight: Children's media use in America 2013. commonsensemedia.org. Retrieved from https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013

Cook, M. (2014). Write to TV: Out of your head and on to the screen. Burlington, MA: Taylor & Francis.

Eyal, K. & Dailey, R.M. (2012) Examining relational maintenance in parasocial relationships. *Mass Communication and Society, 15*(5), 758-781. doi: 10.1080/15205436.2011.616276

Federal Communication Commission. (1996, August). Report and order: In the matter of policies and rules concerning children's television programming.

Fisch, S. M. (2000). A capacity model of children's comprehension of educational content on television. *Media psychology*, *2*(1), 63-91. doi: 10.1207/S1532785XMEP0201_4

Fisch, S. M. (2009). Educational television and interactive media for children: Effects on academic knowledge, skills, and attitudes. In J. Bryant & M. B. Oliver (Eds.), Media Effects: Advances in Theory and Research (3rd Edition). New York, NY: Routledge.

Fisch, S.M., Truglio, R.T., & Cole, C.F. (1999). The impact of Sesame Street on preschool children: A review and synthesis of 30 years' research. *Media Psychology*, 1, 165-190.

Furió, D., GonzáLez-Gancedo, S., Juan, M. C., Seguí, I., & Costa, M. (2013). The effects of the size and weight of a mobile device on an educational game. *Computers & Education*, *64*, 24-41.

Gola, A. A., Richards, M. N., Lauricella, A. R., & Calvert, S. L. (2013). Building meaningful relationships between toddlers and media characters to teach early mathematical skills. *Media Psychology,* 16, 390–411.

Granic, I., Lobel, A., & Engels, R. C. (2014). The benefits of playing video games. *American Psychologist*, *69*(1), 66. doi: 10.1037/a0034857

Green, C. S., & Bavelier, D. (2012). Learning, attentional control, and action video games. *Current Biology, 22,* 197–206. doi:10.1016/j.cub.2012.02.012

Hartmann, T., & Goldhoorn, C. (2011). Horton and Wohl revisited: Exploring viewers' experience of parasocial interaction. *Journal of Communication*, *61*(6), 1104-1121. doi:10.1111/j.1460-2466.2011.01595.x

Horton, D., & Wohl, R. (1956). Mass communication and parasocial interaction: Observations on intimacy at a distance. *Psychiatry, 19*(3), 215-229.

iVillage. (2014, February 28). 9 Great Learn to Read apps for kids. Retrieved from http://www.today.com/parents/9-great-learn-read-apps-kids-t75961

Kabali, H. K., Irigoyen, M. M., Nunez-Davis, R., Budacki, J. G., Mohanty, S. H., Leister, K. P., & Bonner, R. L. (2015). Exposure and use of mobile media devices by young children. *Pediatrics*, *136* (6), 1044-1050.

Kail, R. (2012). *Children and their development*. Upper Saddle River, NJ: Pearson.

Kato, P. M., Cole, S. W., Bradlyn, A. S., & Pollock, B. H. (2008). A video game improves behavioral outcomes in adolescents and young adults with cancer: A randomized trial. *Pediatrics, 122,* e305–e317. doi:10.1542/peds.2007-3134

Katz, E., Liebes, T., & Berko, L. (1992). On commuting between television fiction and real life. *Quarterly Review of Film and Video,* 14, 157-178.

Kirkorian, H. L., Wartella, E. A., & Anderson, D. R. (2008). Media and young children's learning. *The Future of Children*, *18*(1), 39-61.

Kunkel, D. (1998). Policy battles over defining children's educational television. *The Annals of the American Academy of Political and Social Science, 557*, 39-53. **doi:** 10.1177/0002716298557000004

Lauricella, A. R., Barr, R. F., & Calvert, S. L. (2009). Emerging computer skills: Influences of young children's executive functioning abilities and parental scaffolding techniques in the US. *Journal of Children and Media*, *3*(3), 217-233.

Lauricella, A. R., Gola, A. A. H., & Calvert, S. L. (2011). Toddlers' learning from socially meaningful video characters. *Media Psychology*, *14*(2), 216-232.

Lieberman, D. (2001). Management of chronic pediatric diseases with interactive health games: Theory and research findings. *Journal of Ambulatory Care Management, 24*(1), 26–38.

Linebarger, D. L., & Piotrowski, J. T. (2010). Structure and strategies in children's educational television: The roles of program type and learning strategies in children's learning. *Child Development*, 81(5), 1582-1597.

Linebarger, D. L., & Vaala, S. E. (2010). Screen media and language development in infants and toddlers: An ecological perspective. *Developmental Review*, *30*(2), 176-202.

Linebarger, D. L., & Walker, D. (2005). Infants' and toddlers' television viewing and language outcomes. *American Behavioral Scientist*, 48(5), 625-645.

McKnight, L., & Fitton, D. (2010, June). Touch-screen technology for children: Giving the right instructions and getting the right responses. In *Proceedings of the 9th international conference on interaction design and children* (pp. 238-241). ACM.

Michela, J., & Contento, I. (1986). Cognitive, motivational, social, and environmental influences on children's food choices. *Health Psychology, 5,* 209-230.

Murphy, R., Penuel, W. R., Means, B., Korbak, C., Whaley, A., & Allen, J. E. (2002). *E-DESK: A review of recent evidence on the effectiveness of discrete educational software.* Palo Alto, CA: SRI International.

NAEYC & Fred Rogers Center for Early Learning and Children's Media. (2012). Technology and interactive media as tools in early childhood programs serving children from birth through age 8: Joint position statement. Washington, DC: NAEYC; Latrobe, PA: Fred

Rogers Center for Early Learning at Saint Vincent College. Retrieved from www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf

Papa, M. J., Auwal, M. A., & Singhal, A. (1997). Organizing for social change within concertive control systems: Member identification, empowerment, and the masking of discipline. *Communication Monographs,* 64, 219-250.

Papa, M. J., Singhal, A., Law, S., Pant, S., Sood, S., Rogers, E. M., & Shefner-Rogers, C. L. (2000). Entertainment-education and social change: an analysis of parasocial interaction, social learning, collective efficacy, and paradoxical communication. *Journal of Communication*, *50*(4), 31-55.

PBSKids. (2016). Martha Speaks: Dog Party [Mobile application software]. Retrieved from http://play.google.com

PBS Kids. (2017). Super Why! Power to Read (Version 3.4.0) [Mobile application software]. Retrieved from http://play.google.com

Piaget, J. (1964). Part I: Cognitive development in children: Piaget development and learning. *Journal of Research in Science Teaching*, *2*(3), 176-186.

Piasta, S. B. (2016). Current understandings of what works to support the development of emergent literacy in early childhood classrooms. *Child Development Perspectives*, *10*(4), 234-239. doi**:** 10.1111/cdep.12188

Piotrowski, J. T. (2014). Participatory cues and program familiarity predict young children's learning from educational television. *Media Psychology*, *17*(3), 311-331.

Piotrowski, J. T., Vossen, H. G. M., & Valkenburg, P. M. (2015). Media and child development. *International Encyclopedia of the Social & Behavioral Sciences, (2)*15, 1-10.

Radesky, J. S., Schumacher, J., & Zuckerman, B. (2015). Mobile and interactive media use by young children: The good, the bad, and the unknown. *Pediatrics*, *135*(1), 1-3. DOI: 10.1542/peds.2014-2251

Rafaeli, S. (1988). Interactivity: From new media to communication. In R. P. Hawkins, J. M.Wiemann, & S. Pingree (Eds.), *Advancing communication science: Merging mass and interpersonal processes* (pp. 110–134). Newbury Park, CA: Sage.

Richards, M. N., & Calvert, S. L. (2016). Parent versus child report of young children's parasocial relationships in the United States. *Journal of Children and Media*, 1-19.

Rideout, V. (2014, January). Learning at home: Families' educational media use in America. *New York, NY: Joan Ganz Cooney Center*.

Roskos, K., & Christie, J. F. (2000). *Play and Literacy in Early Childhood : Research From Multiple Perspectives*. Mahwah, N.J.: Lawrence Erlbaum Associates, Inc.

Shuler, C. (2012). iLearnII: An analysis of the education category on Apple's app store. New York: The Joan Ganz Cooney Center at Sesame Workshop.

Simone, I. (2014, May 23). 5 Apps to Boost Math Skills over the Summer. Retrieved from https://www.commonsensemedia.org/blog/5-apps-to-boost-math-skills-over-the-summer

Steinberg, L., Vandell, D.L., & Bornstein, M. (2011). *Development: Infancy through adolescence*. Belmont, CA: Wadsworth, Cengage Learning.

Strasburger, V. C., Jordan, A. B., & Donnerstein, E. (2012). Children, Adolescents, and the Media:: Health Effects. *Pediatric Clinics of North America*, *59*(3), 533-587.

Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher–student interaction: A decade of research. *Educational Psychology Review*, *22*(3), 271-296. doi:10.1007/s10648-010-9127-6

Vatavu, R. D., Cramariuc, G., & Schipor, D. M. (2015). Touch interaction for children aged 3 to 6 years: Experimental findings and relationship to motor skills. *International Journal of Human-Computer Studies*, 74, 54-76.

Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wartella, E., O'Keefe, B., & Scantlin, R. (2000). Children and interactive media. *A Compendium of Current Research and Directions for the Future, Markle Foundation*.

Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child development*, *69*(3), 848-872. DOI: 10.2307/1132208

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving*. *Journal of Child Psychology and Psychiatry*, *17*(2), 89-100.